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SURVEY OF GASTROINTESTINAL PARASITES IN CAPTIVE WILD ANIMALS AT ZOOLOGICAL GARDEN, KANO, NORTH WESTERN NIGERIA

[*1]Shafiu Nafiu Abdullahi, [2]Bashir Sani, [3]Maryam Habeeb Muhammad, [4]Ahmad Abdullahi, [5]Maryam Lawal Faragai, [6]Bello Abubakar Kabir

[1, 5, 6]Department of Life Sciences, Kano State Polytechnic, Kano- Nigeria
[2, 4] Department of Science Laboratory Technology, Kano State Polytechnic, Kano
[3]Department of Pharmaceutical Technology, Kano State Polytechnic

ORCID Id: [1] https://orcid.org/0000-0002-1266-6323

Corresponding author: shafiu.nafiu@kanopoly.edu.ng, +2348064042006

Abstract

This survey was carried out to determine the prevalence and intensity of gastrointestinal parasites in captive wild animals at Kano Zoological garden between October and December, 2016. One hundred and seventy six (176) fecal samples were collected from 43 captive wild animals and examined using direct wet mount, zinc floatation and sedimentation methods. Nine species of intestinal parasites from helminthes 6(62.7%) and protozoa 3(32.7%) were identified with an overall prevalence of 39.2%. Trichuris trichuira had the highest prevalence (25.6%) among the helminthes, followed by Strongyloides sp. (16.2%), Ascaris lumbricoides (11.6%) while Hymenolepis diminuta and Entrobius vamicularis recorded the least each with 4.6%. There was significant difference of helminthes infection (P< 0.05) among the animals. Among the protozoa encountered Entamoeba histolytica had the highest of 18.6% prevalence, followed by Giardia lamblia and Balantidium coli which had 9.3% and 2.3% respectively. No significant difference (P>0.05) was observed in the prevalence rate of protozoa parasites. Multiple infection was recorded in Mona monkey and Dog faced baboon with four gastrointestinal parasites, followed by sooty mongabey, Red patas monkey, Mona monkey, lion, Nile crocodile, Elephant, red dorcas gazelle each with three parasites. Single infections were recorded in spotted hyena, sand fox, tortoise and white dorcas gazelle. There was light infection among all animals examined. It is therefore recommended that periodic epidemiological investigation should be carried out on the prevalence of gastrointestinal parasites in order to curtail the potential danger to visitors, keepers and other captive animals in the zoo.

Key words: Gastrointestinal Parasites, Captive wild Animals, Survey, Zoological Garden, Kano North western Nigeria

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INTRODUCTION

A zoological garden is a form of exsitu conservation which involves keeping wild animals alive outside their natural environment for aesthetic, educational, research and recreational purposes (Dharmarajan *et al*., 2005, Adeniyi *et al.,* 2015). In the wild, animals might have a natural resistance against parasitic infections or live in a balanced system with their parasites (Nganga *et al*., 2004). But the change in environment and living conditions from freedom to captivity influences the animal's ecology and might increase the sensitivity for parasitic infections (Goossensa, 2005). Confined areas in zoo enclosure make captive animals more prone to different parasitic infections despite proper attention to feeding, water and maintenance of hygiene in captivity (Atanaskova *et al.,* 2011). Unfortunately, inadequate information on disease and parasite of zoo animals is a major limiting factor in zoological gardens (Dharmarajan *et al*., 2005). In Nigeria there is scanty of data rephrase on the diseases and parasites harboured by wild animals in captive and wild settings (Egbetade *et al.,* 2014). In addition, some parasites are zoonotic and are at risk to human health (Kashid *et al*., 2002). Parasites can affect host survival and reproduction directly through pathological effects (blood loss, tissue damage, spontaneous abortion, congenital malformations and death) and indirectly by reducing the host's immunity and affecting the physical condition (Kuchai *et al*., 2011). Epidemiological Investigations into endoparasitic fauna are important for the study of the prevalence, geographical distribution, systematic and biology of the parasites (Parsani *et al*., 2001). In view of the forgoing, this study aimed to determine the prevalence and intensity of gastrointestinal parasites among some captive wild animals in Kano State Zoological garden, Nigeria.

MATERIALS AND METHODS

Study area

Kano Zoo is the largest state government owned zoo in Nigeria; opened in 1972 by the military governor of Kano State, Alhaji Audu Bako. It is within the Sudan Savanna zone of west Africa about 840 km from the edge of the Sahara desert and 1,140 km from the Atlantic Ocean. It covers an area of about 46 hectares with about 75 different species, comprising about 350 animals. The temperature of Kano usually ranges between a maximum of 33°C and a minimum of 18.85°C (Bichi *et al.,* 2016) please cite figure 1.

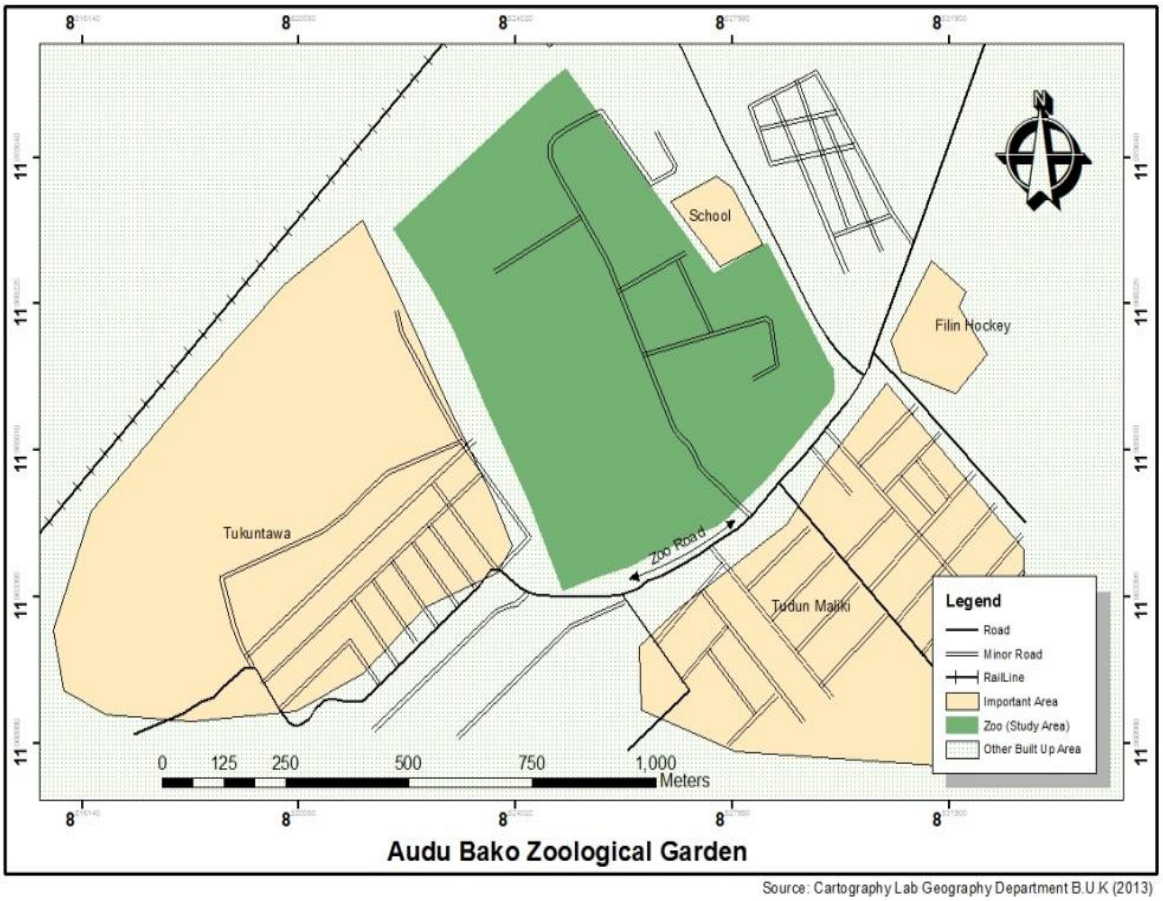

Figure 1: Map of Audu Bako Zoological Garden Kano State Nigeria. Source: Cartography Lab. Geography Department Bayero University Kano (2016)

Sample Collection and Transportation

A total of 176 fresh faecal samples were collected between the hours of 7-8am from 43 different captive's animals with help of animal keepers in sterilized dry stool containers which were marked with the animal species, location, animal type, feeding behaviour, number and cage of the animal. They were put in polythene bag to prevent parasitic or bacterial auto infection as described by Cheesbrough (2009). The samples were transported immediately to the Biology Laboratory, Kano State Polytechnic for further examination**.**

Direct Wet Mount method

Direct Wet Mount method as described by Cheesbrough (2009) was applied as follows: a drop of fresh physiological saline was placed at the center of a clean grease-free glass slide. With the aid of applicator stick, little amount of the faecal specimen was picked and placed in the saline preparation. It was emulsified thoroughly by removing any debris. The entire preparation was then covered with cover-slip and observed under ×10 objective and ×40 objective Olympus binocular microscope. Trophozoites and cysts/eggs were identified based on microscopic morphology.

Zinc Sulphate Floatation method

The method described by Ochei and Kolhatkar (2007) was employed as follows: A small quantity of faeces (3gm) was mixed well with water (15ml) and emulsion was strained through a nylon tea strainer to remove coarse faecal material. Zinc sulphate sucrose mixture was added, centrifuged at l, 500rpm for 3 minutes and the supernatant was poured into another test tube. Another 6ml of floatation medium was added to the sediments, shaken vigorously and centrifuged at l, 500rpm for 2-3 minutes. The supernatant was added together making 12ml of supernatants. A drop of the fluid was placed on a clean, dry glass slide from the top layer of fluid and examined under low power (10X) of the microscope.

Sedimentation Method

The method described by described by Ochei and Kolhatkar (2007) was employed as follows: A small quantity of faeces (3gm) was mixed well with water (15ml) and the resulting emulsion was strained through a nylon tea strainer to remove coarse faecal material. The filtrate was poured into a centrifuge tube and centrifuged at 1500 rpm for 5 minutes. The supernatant was decanted and a drop of the sediment was taken on a clean, dry glass slide and examined under low power (10X) of the microscope. The identification of ova/cyst was done on the basis of various morphological and morphometric characters as described by Cheesbrough (2009) and (FAO, 2010).

Determination the Intensity of the Gastrointestinal Parasites

Procedure adopted by Ghoke *et al.* (2012) was used to determine the intensity of the gastrointestinal parasites. Based on Egg per gram (EPG) of feacal samples. EPG = Number of eggs x 100 (where 100 is the dilution factor). Three classes of severity of the infection was used as follows; <500 (+), between 500 and 1000 (++) and more than 1000 (+++).

DATA ANALYSIS

Data obtained from the study were analyzed using Chi-square test in SPSS 16 version. The level of significance was set at $P<0.05$.

RESULTS

The prevalence of gastrointestinal parasites of helminthes and protozoa in 43 captive wild animals from Kano Zoological garden revealed an overall infection rate of 39.2%. Out of 176 feacal samples examined, *Trichuris trichiura* had the highest prevalence (25.6%), followed by *Strongyloides* sp. (16.2%), *Ascaris lumbricoides* (11.6%) while *Hymenolepis diminuta* and *Entrobius vamicularis* recorded the least each with 4.6%. The helminths infection was not statistically significant among the captive animals ($P<0.05$) (Table 1). *Entamoeba histolytica* had the highest (18.6%) prevalence among the protozoan, followed by *Giardia lamblia* and *Balantidium coli* which had 9.3% and 2.3% respectively. No significant difference ($P>0.05$) was observed in the prevalence rate of protozoa parasites (Table 1).

Table 2 revealed the parasitic infection of helminthes based on the type of captive animal. Nine (9) gastrointestinal parasitic species which constitutes 62.7% from helminthes were encountered. Among which *A.lumbricoides* had the highest prevalence of 100% in sooty mongabey and tortoise while dog faced baboon had the lowest of 50%. *Trichuris trichuira* had the highest prevalence of 100% in each sooty mongabey, Tantalus monkey, spotted hyena, elephant and red dorcas gazelle while the lowest prevalence of 50% was in common jackal. *Entrobius vamicularis*

had its highest prevalence of 100% in sooty mongabey and chimpanzee while *Strongyloides* sp. recorded its highest prevalence (100%) in Zebra, white and red dorcas gazelle. Hookworm had its highest prevalence of 100% in elephant and the lowest of 33.3% in dog faced baboon. In the case of *Hymenolepis diminuta* 80% prevalence was recorded in Mona monkey and the lowest of 50% in lion. However sand fox had no helminthes parasitic infection during the study period.

Table 3, illustrates the prevalence of protozoan parasitic infection based on the type of captive animals which revealed that protozoa had 16(37.3%), in which *Entamoeba histolytica* haboured the highest prevalence rate of 100% in sooty mongabey, elephant and red dorcas gazelle while the lowest of 25% was recorded in dog faced baboon. *Giardia lamblia* had its highest prevalence rate of 100% in Zebra, followed by chimpanzee, rated honey badger which had (50%) each respectively. *Balantidium coli* was recovered only in lion with 50% prevalence rate.

The overall distribution of gastrointestinal parasitic infection and intensity is presented in Table 4. It revealed that of the 176 feacal samples 69(39.2%) were infected with either single or mixed infection. All the captive animals examined had mixed infection of helminthes and protozoa with the exception of spotted hyena, sand fox, tortoise and white dorcas gazelle which had single infection. The intensity of the parasitic infection of the different parasites was determined by EPG, in which all the eggs/cysts identified had below 500EPG indicating light infection.

DISCUSSION

The overall prevalence of gastrointestinal parasites in the captive animals revealed an infection rate of 39.2%, which is higher than 23.7% and 26.06% recorded by Adeniyi *et al.* (2015) and Bichi *et al*. (2016) in university of Ibadan and Kano Zoological Garden respectively. The present finding is lower than 76.6%, 43.75%, 58.06%, 46.2% and 49.1% prevalence reported by Opara *et al*. (2010) in Nekede Owerri Zoological garden, South east Nigeria, Ghoke *et al*. (2012) in Sidnaharth Minicipal Zoo, India, Dawet *et al*. (2013) in Jos Zoological Garden, Nigeria, Thawai *et al.* (2014) in Nandan Van Zoo, India and Adeniyi *et al.* (2015) in University of Ibadan Zoological garden respectively. The low prevalence rate of 39.2% recorded in this study could be due to low level of exposure to the infective stages of the parasites as reported by Kuchai *et al*. (2011) and Thawai *et al*. (2014).

The prevalence of helminthes with 62.7% and protozoa with 37.3% recorded in this study is in agreement with the finding of Munene *et al*. (1998) who reported higher helminthes and protozoa infection of (64.4% and 17.1% in Kenya. The highest percentage of helminthes in the present study is in consistent with the work of Opara *et al*. (2010) and Dawet *et al*. (2013) and Bichi *et al*. (2016). This could perhaps be attributed to the climatic condition which favours the development of the parasite as reported by (Magona and Mussi, 1999). It could also be due to the possession of direct life cycle by many nematodes which do not need any intermediate host and therefore are transmitted through feacal contamination of food, water and soil. Thawai *et al*. (2014) reported that some geo helminthes potentially accumulate in a captive environment especially in open soil enclosure which cannot be easily disinfected. Mbora and Munene (2006) also reported helminthes as the dominant gastrointestinal parasites of primate in zoological garden, Kenya. The present study recorded *T. trichuira* (25.6%) and *E. histolytica* (18.6%) as the most prevalent parasites identified. This observation is in consistent with the findings of Bichi *et al*. (2016).

With respect to multiple infection Mona monkey and Dog faced baboon had highest number with four gastrointestinal parasites, followed by sooty mongabey, Red patas monkey, Mona monkey, lion, Nile crocodile, Elephant, red dorcas gazelle each with three parasites. Single infections were recorded in spotted hyena, sand fox, tortoise and white dorcas gazelle. The variation in the endoparasitic load could be attributed partly due to the differences in immune response to the infections and partly due to the inadequate hygienic measures in their management as reported by Dawet *et al*. (2013) in Jos Zoological Garden. The high prevalence of multiple infections could also be due to the fact that same species of these captive animals are kept in the same enclosure which could subject them to sharing infestation. Similar observation was reported by Ghoke*et al.* (2012), Adetunji (2014) and Azubuike and Amarachi (2014). Most of the helminths species identified from the present study have previously been reported in Nigeria and elsewhere in captive wild animals as reported by Adeniyi *et al*. (2015). The present finding is in tandem with that of Varadharajan and Kandasamy (2000) and Ajibade *et al*. (2010), who reported that parasitic diseases caused by intestinal helminths have a higher prevalence in zoo animals of the countries with warm and tropical climates, due to favorable development factors such as light, temperature and moisture.

The intensity of parasitic infection from the feacal sample which determined the amount of infection the animal suffering from revealed light infection of 10 – 300 egg per gram (EPG).This observation corroborates with the work of Thawai *et al*. (2014) who recorded low intensity (100-300EPG) of GI parasitic infection in Nandan Van Zoo. The Low intensity of gastrointestinal parasitic infections recorded in this study in captive animals could be attributed to management practices in the zoo or high immune response by the animals.

CONCLUSION AND RECOMMENDATIONS

It is concluded that overall gastrointestinal parasitic infection was prevalent (39.2%) with helminthes (62.7%) and protozoa (37.3%). Mona monkey and dog faced baboon had the highest parasitic load and the least were spotted hyena, sand fox, tortoise and white dorcas gazelle. No alarming signs of parasitic infection were examined in animals due to low parasitic infection with light intensity. Moreover light infection should be monitored in order to curtail zoonotic potentialities or by serving as reservoir host for some pathogens. It is therefore recommended that detailed epidemiological investigation on the prevalence of gastrointestinal parasites in captive animals with respect to season, age, and climatic condition need to be assessed. Administration of desired antihelminths to the animals periodically coupled with good sanitary measures need to be enhanced.

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Table 1: Prevalence of Gastrointestinal Parasites among Captive Animals in Kano Zoological Garden (October – December, 2016)

Types of animal species	No. of animals examined	No. of samples collected	% of positive samples	% prevalence of single infection	% prevalence of mixed infection	Type of Parasites encountered	Intensity of infection	EPG
Sooty mangabey (*Cercocebus atys*)	1	4	2(50)	1(50)	1(50)	*A. Lumbrcoides , T. trichuira, E. histolytica*	+	10-300
Tantalus monkey (*Cercopithecus tantalus*)	3	12	3(25)	1(25)	2(75)	*T. trichuira, Hookworm*	+	10-300
Chimpanzee (Pan trogolodytes)	2	8	3(50)	1(50)	1(50)	*E. vamicularis, Giardia lamblia*	+	10-100
Dog faced baboon (*Papioanubis)*	4	16	10(62.5)	6(60)	4(40)	*A. Lumbrcoides , E. histolytica, Strongyloides sp.*	+	10-300
Red patas monkey *(Erythrocebus patas*)	3	12	6(50)	3(50)	3(50)	*Hookworm, E. histolytica, H. diminuta*		10-100
Mona monkey (*Cercopithecus mona)*	5	20	16(80)	12(60)	4(40)	*T. trichuira, A. lumbricoides, E. histolytica, H. diminuta*		
Lion *(Pantheraleo)*	2	8	4(50)	1(25)	3(75)	*T. trichuira, B.coli, Strogyloides sp.*	+	
Spotted hyaena (*Crocuta crocuta)*	2	8	2(25)	1(100)	0.0 (0.0)	*T. trichuira*	+	
Nile crocodile *(Crocodiles niloticus)*	4	16	4(25)	2(50)	2(50)	*T.trichuira, E. histolytica*	+	10-300
Stripped hyaena (*Hyaena hyaena)*	2	8	3(12.5)	0.0	3(100)	*T. trichuira, strongyloides sp.*	+	10-200
Common Jackal (*Canis aureus)*	4	16	3(18.8)	2(75)	1(25)	*T. trichuira, E. histlytica*	+	10-100
Rated honey badger (*Millevora capensis)*	2	8	2(25)	0.0	2(100)	*Strongyloides sp., Giardia lamblia*	+	10-300
Sand fox *(Vulpesferilata*)	1	8	1(12.5)	1(100)	0.0	*Giardia lamblia*	-	10-300
Elephant (*Lexodonta africana)*	1	4	2(50)	0.0	2(100)	*T.trichuira, E. histolytica, Hookworm*	+	10- 300
Giraffe (*Giraffa cameliopardalis)*	3	12	2(16.6)	0.0	2(100)	*A. lumbricoides, T. trichuira*	+	10-200
Zebra (*Equus burchelli)*	1	4	2(50)	1(50)	1(50)	*Giardia lamblia, Strongyloides sp.*	+	10-100
Tortoise (*Testudo graeca)*	1	4	1(25)	1(100)	0.0	*A. lumbricoides*	+	10-200

White dorcas Gazella (*Gazella dorcas*)	1	4	2(50)	2(100)		*Strongyloides sp.*	+	10-300
Red dorcas Gazella*(Gazellarufirons)*	1	4	1(25)	1(100)	0.0	*Strongyloides sp., E. histolytica, T. trichuira*	+	10-100
Total	43	176	69(39.2)					

Table 2: Prevalence of Parasitic Infection of Helminthes in Relation to Types of Captive Animals in Kano Zoological Garden

Animal species	No. examined	% prevalence	*A. lumbricoides*	*T.trichuira*	*E.vamicularis*	*Strongyloides*sp.	*Hookworm*	*H. diminuta*
Sooty mangabey	1	1(100)	1(50)	1(25)	1(25)			
Tantalus monkey	2	2(100)		1(50)				
Chimpanzee	2	1(50)			1(50)			
Dog faced baboon	4	2(50)	1(50)					
Red patas monkey	3	1(33.3)					1(33.3)	
Mona monkey	5	4(80)	2(20)	1(40)				1(50)
Lion A	2	2(100)		1(50)				
Spotted hyaena	2	2(100)		2(100)				
Nile crocodile	4	2(50)		1(50)			1(50)	
Stripped hyaena	2	1(50)		1(50)				
Common Jackal	4	1(25)		1(50)				
Rated honey badger	2	1(50)				1(50)		
Sand fox	2	0(00)						
Elephant	1	1(100)		2(33.3)				
Giraffe	3	2(66.6)	1(66.6)					
Zebra	1	1(100)				1(50)		
Tortoise	1	1(100)	1(100)					
White dorcas Gazella	1	1(100)						
Red dorcas Gazella	1	1(100)		0				
Total	43	27(62.7)	5(11.6)	8	1(2.04)	2(4.08)	2(4.08)	1(2.04)

Table 3: Prevalence of Parasitic Infection of Protozoa in Relation to Types of Captive Animals in Kano Zoological Garden

Animal species	No. examined	No infected	*E. histolytica*	*Balantidium coli*	*Giardia lamblia*	
Sooty mangabey	4	3	1(25)	1(25)		0.0
Tantalus monkey	3	1		1(33.3)		
Chimpanzee	2	1			1(50)	
Dog faced baboon	4	1	1(25)			
Red patas monkey	3	1	1(33.3)			
Mona monkey	2	1	1(50)			
Lion A	1	0.0		1(50)		
Spotted hyaena	2	1	1(50)			
Nile crocodile	4	1			1(25)	
Python	2	1			1(50)	
Common Jackal	2	1	1(50)			
Rated honey badger	2	1	1(50)			
Sand fox	1	1	1(100)			
Elephant	6	3	3(50)			
Giraffe	2	0.0				
Zebra	2	2			2(100)	
Tortoise	3	0.0				
White dorcas Gazella	2	1	1(50)			
Red dorcas Gazella	1	1	1(100)			
Total	49	21(42.8%)	13(26.5)	3(6.1)	5(10.2)	

Table 4: Prevalence of Gastrointestinal Parasites Among Captive Animals in Kano Zoological Garden

Types of parasite	No. of animals examined	No. of parasites encountered	% Prevalence of parasites identified
Cestoda			
Hymenolepis diminuta eggs	43	2	4.6
Nematoda			
T. trichiuria eggs	43	11	25.6
*Strongyloides*sp. *larva*	43	7	16.2
Ascaris Lumbriciodes eggs	43	5	11.6
Entobiusvermicularis eggs	43	1	2.3
Hookworm eggs	43	3	6.9
Protozoa			
*Entamoeba Histolytica*cyst	43	8	18.6
Balantidium Coli cyst	43	1	2.3
*Giardia lamblia*cysts	43	4	9.3

$X^2 = 4.31$ df= 8 P<0.05