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## COMMUNICATION

### PARASITIC INFECTION IN CAPTIVE WILD MAMMALS AND BIRDS IN BANGABANDHU SHEIKH MUJIB SAFARI PARK, COX'S BAZAR, BANGLADESH

M. Najmul Hossain, Anita Rani Dey, Nurjahan Begum & Thahsin Farjana

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## Parasitic infection in captive wild mammals and birds in Bangabandhu Sheikh Mujib Safari Park, Cox's Bazar, Bangladesh

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**Abstract:** We investigated the infection rate of gastrointestinal (GI) parasite eggs and premature stages from different wild animals and birds in Bangabandhu Sheikh Mujib Safari Park, Dulahazra, Cox's Bazar. A total of 56 fecal samples were collected from 24 species during July to November 2012 using modified Stoll's ova dilution technique. Coprology analysis revealed that the overall rate of parasitic infection was 78.6%, of which 51.8% were helminths and 35.7% protozoa. The identified parasites were *Paramphistomum* spp. (7.1%), *Fasciola* spp. (5.4%), strongyles (26.8%), *Ascaris* spp. (3.6%), *Strongyloides* spp. (7.1%), *Dictyocaulus* spp. (5.4%), *Trichuris* spp. (3.6%), *Capillaria* spp. (5.4%), *Heterakis* spp. (3.6%), and *Balantidium coli* (35.7%). Mixed infection (21.4%) was observed in nine animals, including co-infection with *Balantidium coli* and strongyles in Tiger *Panthera tigris*, Sambar Deer *Rusa unicolor* and Pig-tailed Macaque *Macaca nemestrina*, *Strongyloides* spp., *Trichuris* spp. and larvae of *Dictyocaulus* spp. in Capped Langur *Trachypithecus pileatus*, *Balantidium coli* and *Capillaria* spp. in Clouded Leopard *Neofelis nebulosa*, *Fasciola* spp. and *Balantidium coli* in Spotted Deer *Axis axis*, *Ascaris* spp. and strongyles in African Elephant *Loxodonta africana*, *Strongyloides* spp. and *Heterakis* spp. in Peafowl *Pavo cristatus* and *Heterakis* spp. and strongyles co-infection in Great Pied Hornbill *Buceros bicornis*. It is concluded that GI parasites were prevalent in this safari park. Further epidemiological investigation is necessary for controlling parasitic infection.

**Keywords:** *Ascaris*, *Balantidium coli*, *Capillaria*, *Dictyocaulus*, *Fasciola*, GI parasites, *Heterakis*, infections, *Paramphistomum*, strongyles, *Strongyloides*, *Trichuris*.

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**Author contribution:** ARD and NB conceptualized and designed the study. MNH collected samples. MNH and ARD identified parasites and analyzed the data. MNH, TF and ARD drafted the paper and made final revisions. NB and TF made critical revision of the manuscript. All the authors read the final version of the manuscript and approved it.

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## INTRODUCTION

Conservation of wildlife in many parts of the world is associated with zoological gardens (Parsani et al. 2001a). Zoo populations are unique and important sources for studying wildlife and their habitats, and to preserve endangered species through captive breeding and reintroduction programs (Schulte-Hostedde & Mastromonaco 2015). Parasitic diseases constitute a major problem for these animals while in captivity (Rao & Acharjyo 1984). In nature, practically no animal is free from parasitic infection, but they often develop resistance from low grade infections. Captive animals are vulnerable to GI parasites, which often cause severe illness or death. Common GI parasites of captive birds and mammals include nematodes, trematodes, cestodes and protozoa. It is possible to eliminate these parasites by giving proper attention to feeding, water and maintenance of hygiene, husbandry practices, disease prophylaxis and treatment in captivity. Usually, captive animals do not show alarming signs of parasitism if regular deworming practices are carried out (Parsani et al. 2001a).

The study of wildlife while in captivity has contributed greatly to our current biological knowledge. Zoos, wildlife breeding centers and research institutions are playing a vital role in this respect. Investigations on endoparasitic fauna are important for the study of their prevalence and geographical distribution (Zasityte & Grikienciene 2002). In Bangladesh, very few zoological gardens, safari parks and eco parks have been established which act as an important source of recreation for people of all ages. Among them, safari park is the wildlife park where visitors can observe freely roaming animals from protected vehicles (Chipperfield 1975). There have been few comprehensive studies on the prevalence of intestinal parasites in animals in zoological gardens of Bangladesh (Raja et al. 2014). The present study aimed to identify GI parasites and their present status in birds and mammals of Bangabandhu Sheikh Mujib Safari Park.

## MATERIALS AND METHODS

### Study area

This study was conducted at Bangabandhu Sheikh Mujib Safari Park, Dulahazra, Cox's Bazar, Bangladesh. The samples were examined in the laboratory, Department of Parasitology, Bangladesh Agricultural University, Mymensingh.

### Study period

The study was conducted from July to November 2012.

### Selection of animals

A total of 56 samples were collected from species including: Tiger *Panthera tigris* (4), Lion *Panthera leo* (4), Asiatic Black Bear *Ursus thibetanus* (4), Clouded Leopard *Neofelis nebulosa* (3), Black Fox *Vulpes vulpes* (1), Hog Deer *Axis porcinus* (4), Sambar *Rusa unicolor* (4), Spotted Deer *Axis axis* (4), Hippopotamus *Hippopotamus amphibious* (2), African Elephant *Loxodonta africana* (3), Wildebeest *Connochaetes taurinus* (4), Gayal *Bos frontalis* (2), Langur *Semnopithecus* sp. (2), Capped Langur *Trachypithecus pileatus* (3), Monkey *Macaca fascicularis* (2), Hoolock Gibbon *Hoolock hoolock* (2), Pig-tailed Macaque *Macaca nemestrina* (1), Emu *Dromaius novaehollandiae* (1), Peafowl *Pavo cristatus* (2), Guinea Fowl *Numida meleagris* (1), Great Pied Hornbill *Buceros bicornis* (1), Indian Pond Heron *Ardeola grayii* (1), and Vulture *Aegypius monachus* (1).

### Collection and preservation of samples

Fecal samples were collected with the help of animal caretakers in the early morning from the floor to prevent contamination. Each sample was placed in a polythene bag containing 10% formalin. The opening edge of the bag was tightly closed and samples were labeled according to species with a marker.

### Coprological examination

All samples were examined at the laboratory, Department of Parasitology, Bangladesh Agricultural University, Mymensingh. The samples were processed for microscopic examination. The ova/ cysts/ larvae of different parasites were identified according to Stoll's ova dilution technique to determine eggs per gram (EPG) or cyst per gram (CPG) of feces as described by Soulsby (1982).

### Micrometry of ova and cyst

The sizes (length by width) in  $\mu\text{m}$  of ova, cysts and larvae of identified parasites were measured (Cable 1965).

## RESULTS

### Overall infection rate of GI parasites in animals

The overall rate of parasitic infection was 78.6% (44), where helminths and protozoan infection were 51.8%

(29) and 35.7% (20), respectively (Table 1). Identified parasites included protozoa *Balantidium coli* (35.7%); nematodes strongyles (26.8%), *Ascaris* spp. (3.6%), *Dictyocaulus* spp. (5.4%), *Strongyloides* spp. (7.1%), *Trichuris* sp. (3.6%), *Capillaria* spp. (5.4%), and *Heterakis* spp. (3.6%); and trematode *Fasciola* spp. (5.4%) and *Paramphistomum* spp. (7.1%) (Table 2). Results indicated that helminth infection were more common than protozoan infection.

#### Infection rate of mixed infection in animals

Mixed infection (21.4%) was observed in nine animals: Tiger, Sambar Deer and Pig-tailed Macaque (*Balantidium coli* and strongyles), Capped Langur (*Strongyloides* spp., *Trichuris* spp. and larvae of *Dictyocaulus* spp.; *Strongyloides* spp., *Trichuris* spp. and larvae of *Dictyocaulus* spp.), Clouded Leopard (*Balantidium coli* and *Capillaria* spp.), Spotted Deer (*Fasciola* spp. and *Balantidium coli*), Elephant (*Ascaris* spp. and larvae of strongyles), Peafowl (*Strongyloides*

spp. and *Heterakis* spp.), Great Pied Hornbill (*Heterakis* spp. and strongyles) (Table 3).

#### Infection rate of GI parasites in carnivores

Among carnivores, 68.8% (11/16) animals were positive for GI parasites, of which 62.5% (10/16) were found positive for protozoa and 18.8% (3/16) samples were positive for helminthes. The detected parasites of carnivores included strongyles (12.5%), *Capillaria* spp. (6.3%) and *Balantidium coli* (62.5%). No parasite was found in Black Fox.

#### Infection rate of GI parasite in herbivores

Among herbivores, 100% animals were positive for GI parasites. Among them, 30.4% and 78.3% samples were found positive for protozoa and helminthes, respectively. The isolated parasites were *Fasciola* spp. (13.0%), *Paramphistomum* spp. (17.4%), strongyles (43.5%), *Balantidium coli* (30.4%), *Ascaris* spp. (8.7%), and *Capillaria* spp. (4.4%).

**Table 1. Infection rate of GI parasites in different animals at Bangabandhu Sheikh Mujib Safari Park.**

Type of animal	No. of sample examined	Protozoa infected (%)	Helminth infected (%)	Mixed infected (%)	Total infected* (%)
Carnivores	16	10 (62.5)	3 (18.8)	2 (12.5)	11(68.8)
Herbivores	23	7 (30.4)	18 (78.3)	4 (17.4)	23 (100)
Primates	10	3 (30.0)	5 (50.0)	4 (40.0)	7 (70.0)
Birds	7	0 (0.0)	3 (42.9)	2 (28.6)	3 (42.9)
<b>Total</b>	<b>56</b>	<b>20 (35.7)</b>	<b>29 (51.8)</b>	<b>12 (21.4)</b>	<b>44 (78.6)</b>

\* Total no. of animals/ birds affected is less than the summation of individual infection because same animal/ bird was infected with more than one type of gastrointestinal parasites

**Table 2. Infection rate of GI parasites in different animals in Bangabandhu Sheikh Mujib Safari Park.**

Types of parasites	Name of the parasites	No. of case	Infection rate (%)	Intensity of infection (EPG/CPG)
Protozoa	<i>Balantidium coli</i>	20	35.7	100–500
Trematode	<i>Paramphistomum</i> spp.	04	7.1	100–300
	<i>Fasciola</i> spp.	03	5.4	100–200
Nematode	strongyles	15	26.8	100–1200
	<i>Ascaris</i> spp.	02	3.6	200–400
	<i>Strongyloides</i> spp.	04	7.1	100–1200
	<i>Dictyocaulus</i> spp.	03	5.5	600–700
	<i>Trichuris</i> spp.	02	3.6	300
	<i>Capillaria</i> spp.	03	5.4	100–700
	<i>Heterakis</i> spp.	02	3.6	100–200



**Table 3. Mixed infection in different animals in Bangabandhu Sheikh Mujib Safari Park.**

Name of animals	Name of parasites	No. of case
Tiger, Sambar Deer and Pig-tailed Macaque	<i>Balantidium coli</i> and strongyles	3
Capped Langur	<i>Strongyloides</i> spp., <i>Trichuris</i> spp. and larvae of <i>Dictyocaulus</i> spp.	2
	<i>Strongyloides</i> spp., and larvae of <i>Dictyocaulus</i> spp.	1
Clouded Leopard	<i>Balantidium coli</i> and <i>Capillaria</i> spp.	1
Spotted Deer	<i>Fasciola</i> spp. and <i>Balantidium coli</i>	1
Elephant	<i>Ascaris</i> spp. and strongyles	2
Peafowl	<i>Strongyloides</i> spp. and <i>Heterakis</i> spp.	1
Great Pied Hornbill	<i>Heterakis</i> spp. and strongyles	1

**Table 4. Micrometry of egg/ cyst of different parasites.**

Name of parasites	Size in $\mu\text{m}$
<i>Balantidium coli</i>	50 x 70
<i>Paramphistomum</i> spp.	160 x 90
<i>Fasciola</i> spp.	87 x 43.5
strongyles	72.5 x 43.5
<i>Strongyloides</i> spp.	58 x 29
<i>Ascaris</i> spp.	70 x 50
<i>Capillaria</i> spp.	45 x 25
<i>Heterakis</i> spp.	70 x 45
<i>Trichuris</i> spp.	79 x 36

#### Infection rate of GI parasite in non-human primates

Among primates, 70.0% animals were positive for GI parasites of which 30.0% and 50.0% samples were found positive for protozoa and helminthes, respectively. The detected parasites were *Strongyloides* spp. (30.0%), *Dictyocaulus* spp. (30.0%) and *Trichuris* spp. (20.0%), strongyles (20.0%), and *Balantidium coli* (30.0%).

#### Infection rate of GI parasite in birds

Among birds, 42.6% samples were positive for GI parasites. No samples were found positive for protozoa. The identified parasites were *Strongyloides* spp. (14.3%), *Heterakis* spp. (28.6%), *Capillaria* spp. (14.3%) and strongyles (14.3%).

#### Intensity of infection of GI parasites in different animals

In the present study, intensity of different parasites in different animals was also measured. The mean EPG/CPG were calculated. The highest CPG (cyst per gram)

was found in Pig-tailed Macaque for *Balantidium coli* as 500. The highest EPG (egg per gram) was found in Capped Langur for *Strongyloides* spp. (1200).

#### Micrometry of egg/cyst of different GI parasites in different animals

The sizes (length by width) in  $\mu\text{m}$  of egg/cyst of different GI parasites were measured in the present study (Table 4).

#### DISCUSSION

The objective of zoological gardens is to protect endangered animal species and to evaluate needs for protecting biodiversity. It helps to gain an accurate and updated knowledge of different diseases that affect wild and exotic animals when in captivity (Mitchell et al. 2009). In case of parasitic infection, animal keepers and visitors play an important role of mechanical vector of parasites and improper feeding systems can enhance the parasitic infection (Nasiri & Jameie 2019).

Overall 78.6% animals were found to be infected with GI parasites, which was close to the previous finding of Raja et al. (2014) at Dhaka Zoo in Bangladesh (78.7%) and slightly higher than the earlier reports of Opara et al. (2010) and Corden et al. (2008) in Nigeria (76.6%) and Spain (72.5%), respectively. The variation may be due to climatic condition, husbandry practice and feeding management of the study area. Environmental contamination could be through contaminated water or fodder, and even zoo workers have also been reported to play a role in transmission by acting as vectors and transmitting parasites through their shoes, clothes, hands, food, or with working tools (Adetunji 2014; Otegbade & Morenikeji 2014).

The infection rate of helminths infection (51.8%) was found higher than protozoan infection (35.7%). This is similar with the report of Parsani et al. (2001a) who revealed that 57.1% animals were positive for helminths infection and 18.8% for protozoa in Rajkot Municipal Corporation Zoo. The present study also confirms the report of Varadharajan & Kandasamy (2000) who recorded that 58.0% animals were positive for helminths infections and 6.0% were positive for protozoan infections. In this study, nematode and protozoan infection were commonly found due to its direct life cycle involving no intermediate host and transmitted by oro-fecal route through contaminated feed, water, and soil and have the potential to accumulate in a captive environment. A few trematode infections and no

cestode infection was recorded because of their indirect life cycle (Parsani et al. 2001b). In this park, animals and birds are reared in protective enclosure giving less chance of accessibility to the intermediate hosts of trematodes and cestodes.

In the present study, mixed infection observed in different animals and birds. The mixed infection in deer was recorded by Kanungo et al. (2010) in majority of the deer. Mutani et al. (2003) reported that 58.5% monkeys were infected with at least three parasite species and only 34.0% with one and two parasite species. This suggests that there is a fairly high rate of transmission of the parasites observed between individuals either because of the monkeys' gregarious nature or because of suitable environmental conditions (Mutani et al. 2003). The finding of mixed infection in this study might be due to presence of all aged animals in the same cages, feeding management and improper disposal of feces.

In this study, it is indicated that 68.8% carnivores were positive for GI infection. This finding is lower than the report of Muller-Graf (1995) and Lim et al. (2008) who reported that the prevalence was 97.3% and 89.3%, respectively. The differences may be due to the subspecies of tigers in this study which are different from the previous. Also the geographical factors and environmental factors are responsible for this variation.

In this study, 100% herbivores were positive for GI parasites. This finding is absolutely higher than the all previous findings. Wahed (2004) reported that 44.4% herbivores were positive with GI parasites. The high prevalence of *Fasciola* sp. (13.5%) and *Strongyloides* spp. (11.5%) in deer was recorded by Mandalet al. (2002). The infection with *Fasciola* sp. in deer was also observed by Maia (2001), Vengušt (2003), Chroust & Chroustova (2004), and Novobilsky et al. (2007). Comparatively, however, higher prevalence rate of *Fasciola* spp. in deer was recorded by Kanungo et al. (2010) as 20% at Dhaka Zoo and 19.1% at Dulahazara Safari Park. This difference might be due to location of animal cages, availability of intermediate hosts near the cages, and the source of feeds. The probable cause of *Fasciola* spp. infection was strongly connected with mud snails that live on the edges of drains and act as intermediate host (Vengust 2003). Another important factor was the green grass and leaves supplied to deer from outside of the zoo, which may be contaminated with metacercaria (Kanungo et al. 2010). At Bangabandhu Sheikh Mujib Safari Park, the chance of contamination is also higher as the cage is located at marshy land and the grass supplied to the deer is also taken from the outside.

Among primates, 70% of animals were infected with

GI parasites. This result is much lower than that of Mutani et al. (2003) who revealed the overall infection rate was 88.7%. On the other hand, lower prevalence rate in primate was recorded by Lim et al. (2008) and Stuart et al. (1990) as 54.5% and 48%, respectively. The present study also confirmed that among the infected primate, there was a lower occurrence of protozoa (20%) than helminth (40%) which is against the earlier report of Lim et al. (2008) who recorded as 35.4% protozoa and 19.1% helminths. *Balantidium coli* were the most prevalent intestinal parasite detected in primates. This finding is an agreement with the earlier report of Levecke et al. (2007). Actually, *Balantidium coli* are common protozoa of animals having a wide host range and possess a simple direct life cycle. The appearance of these parasites can be explained by the simplicity of their life cycle, the low infective dose, the short pre-patent period and ability to survive in the environment.

## CONCLUSIONS

Though there are some coprology studies of GI parasites that have been done in wild animals in different zoos in Bangladesh, this is the first investigation on GI parasites in animals in Bangabandhu Sheikh Mujib Safari Park. Routine monitoring of the presence of parasites in animals and birds are imperative in assisting good management and implementation of preventive and control measures against the spread of infectious parasitic diseases among animals within the park or to humans.

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