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Investigation of gastrointestinal parasites of herbivores at Dhaka National Zoological Garden of Bangladesh

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Abstract

A total of 52 fecal samples were collected from 21 herbivores at Dhaka zoo during January to May, 2012 to investigate the prevalence of gastrointestinal parasites of herbivores. Overall prevalence of parasitic infection was 76.9%, of which 61.5% were positive for helminths and 55.8% were positive for protozoa. The identified parasites were *Balantidium coli* (55.8%), *Paramphistomum* sp. (36.5%), *Fasciola* sp. (19.2%), stomach worm (3.9%), *Ascaris* sp. (1.9%) and *Strongyloides* sp. (1.9%). Overall prevalence of mixed infection was 42.3%. Mixed infection was observed in the animals such as Butani cattle (*Balantidium coli* and *Paramphistomum* sp.), Giraffe (*Balantidium coli* and *Paramphistomum* sp.), Spotted deer (*Balantidium coli, Paramphistomum* sp. and *Fasciola* sp.), Sambar deer (*Balantidium coli* and *Fasciola* sp.), Horse (*Balantidium coli* and *Ascaris* sp.), Greater kudu (*Balantidium coli* and *Paramphistomum* sp.), Nil gai (*Balantidium coli* and stomach worm), Black wilde beast (*Balantidium coli* and *Paramphistomum* sp.), Impala (*Balantidium coli* and *Strongyloides* sp.), Hippopotamus (*Balantidium coli and Paramphistomum* sp.), Zebra (*Balantidium coli* and *Paramphistomum* sp.), Wilde beast (*Balantidium coli* and *Paramphistomum* sp.; *Balantidium coli* and *Paramphistomum* sp. and *Fasciola* sp.), One Horned Rhinoceros (*Balantidium coli* and *Paramphistomum* sp.), Common Eland (*Balantidium coli* and *Paramphistomum* sp.), Oryx (*Balantidium coli* and stomach worm). Diameter of ova or cyst was also measured. Egg per gram/ Cyst per gram of feces (EPG/ CPG) were ranged from 300-1200. Gastrointestinal parasites are highly prevalent in herbivores of Dhaka zoo. Strategic control measure is necessary to protect the endangered species from parasitic infestation.

Keywords: Gastrointestinal parasites, Prevalence, Herbivores, Dhaka zoo

Introduction

Captivity of wildlife creates an unnatural system and disrupts the balance between parasite and host and it makes a stressful environment and become animals diseased or can even die from parasite loads that they would have survived under natural conditions (Van Wyk and Boomker, 2011). In nature, practically no animal is free from parasites. When the parasitized animal is brought from wild to captivity, despite quarantine measures, the new condition of zoos is generally unfavorable for the animal but favorable to the parasites. Occurrence of parasites in animals housed in zoo might vary according to the type of husbandry practices, disease prophylaxis and treatment administered. Usually, captive animals do not show alarming signs of parasitism if regular deworming practices carried out in the zoo (Parasani *et al*., 2001). Intensive husbandry of animals produces conditions which facilitates the spread of parasites. Parasitic diseases often represent a major concern in zoo animals for the high environmental contamination due to the maintenance of animals in confined areas. Moreover, anthelmintics resistance limits the control of parasites of zoo animals. Unfortunately, inadequate information on diseases and parasites of zoo animals is a major limiting factor in zoological gardens. Investigations on endoparasitic fauna are important for the study of the prevalence and geographical distribution (Zasityte and Grikienciene, 2002). 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 among the zoo animal in Dhaka National Zoological Garden, Bangladesh, valuable information will be obtained for the development of public health and preventive medicine. Considering these facts, the present study was undertaken to determine the prevalence and intensity of gastrointestinal parasites and to study the morphometric characters of parasitic egg and cyst in different herbivores.

Materials and Methods

Study area

The study was conducted in herbivores at Dhaka Zoo. Morphological identification of parasitic ova and other developmental stages of parasites were performed in the laboratory of the Department of Parasitology, Bangladesh Agricultural University, Mymensingh.

Study period

This investigation was carried out during the period from January to May, 2012.

Selection of animals

Fifty two samples were collected from different herbivores such as Impala, Nil gai, Gayal, Giraffe, Common Eland, Sambar deer, Maya deer, Spotted deer, Horse, Greater kudu, Hippopotamus, Chimpanzee, Black wilde beast, Water buck, Elephant, wilde beast, Butani cattle, Oryx, Zebra, one Horned Rhinoceros and Ass.

Collection and preservation and shipment of samples

Fecal samples were collected with the help of animal's caretakers in the early morning. Collected fecal sample were placed in a polythene bag containing 10% formalin and the opening edge of the bag was tightly closed with ribbon and marked according to species and brought it to the laboratory.

Coprology examination

Samples were examined and processed for microscopic examination. The ova or cysts of different parasites were identified as described by Soulsby (1982) and quantitative estimation was done by Stoll's ova counting technique to determine eggs per gram (EPG)/ cysts per gram (CPG) of feces.

Stoll's ova dilution technique

The fecal sample was first well mixed and then three grams of feces were weighed with the help of a balance and weight box and taken in 100 ml graduated beaker, which was filled with 45 ml water and thoroughly mixed with water by a magnetic stirrer. The mixture was then strained with a coffee strainer. The strained mixture was again shaken and 0.15 ml of mixture was taken on to a glass slide and covered with a cover slip. Care was taken to avoid bubble formation. Then the slide was placed under a microscope and helminth eggs were identified and counted. The total number of eggs of parasites found in the slide was multiplied by 100 to get the eggs per grams of feces (EPG).

Measurement the diameter of ova and cysts

The length and width of identified eggs and cysts of different parasites in different animals were measured by a micrometer as described by Cable (1965).

Results

Overall prevalence of gastrointestinal parasites in herbivores at Dhaka National Zoo

A total of 52 fecal samples were examined and 40 samples were found to be infected with different types of parasite. At least one intestinal parasite was identified in the fecal samples of each of the animals except Chimpanzee. The overall prevalence of parasitic infection was 76.9% (40) where helminths and protozoan infection were 65.4% (34) and 55.8% (29), respectively (Fig.1). Identified parasites were protozoa (*Balantidium coli*), nematodes (*Strongylus* sp., *Ascaris* sp. and stomach worm) and trematode (*Fasciola* sp. and *Paramphistomum* sp.) (Fig. 2). Results indicated that helminths infection were more common than protozoan infection in herbivore animals (Fig.1).

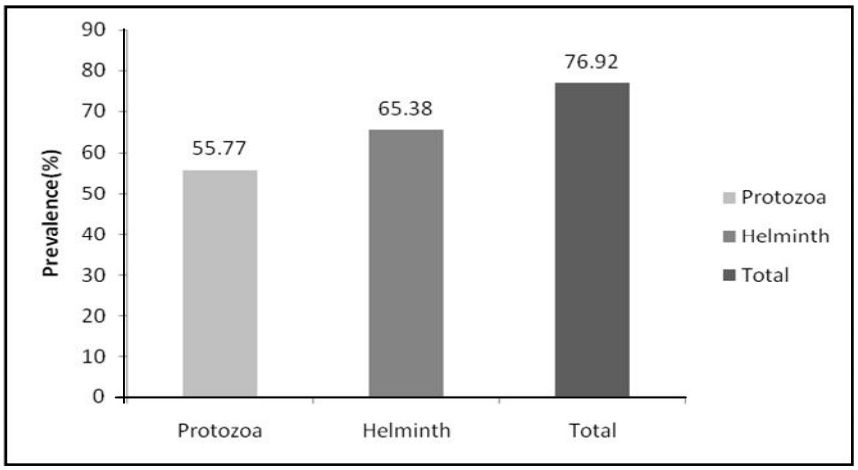

Fig. 1. Overall Prevalence of parasitic infection in herbivore animals at Dhaka Zoo

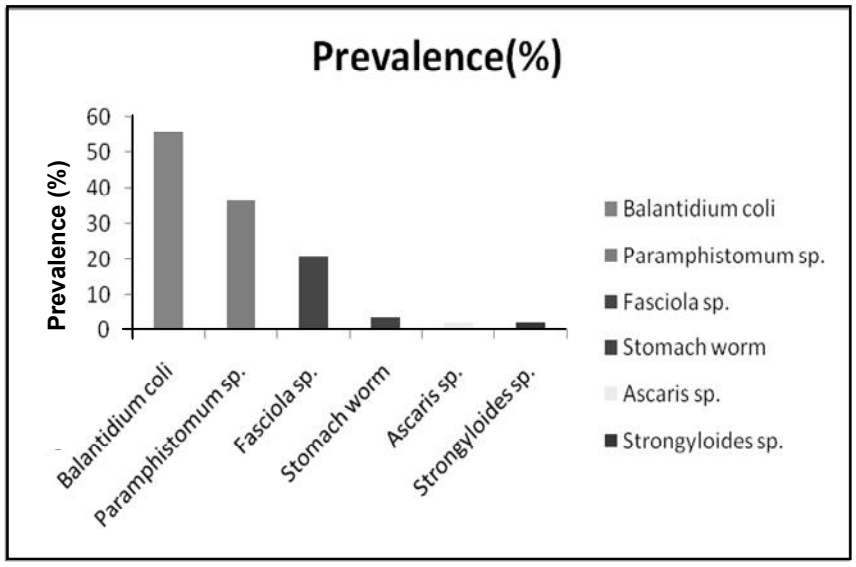

Fig. 2. Prevalence of different parasites in herbivores at Dhaka Zoo

Prevalence and intensity of different gastrointestinal parasites in herbivores at Dhaka Zoo

Identified parasites of herbivores were *Balantidium coli* (55.8%), *Paramphistomum* sp. (36.5%), *Fasciola* sp. (21.2%), stomach worm (3.9%), *Ascaris* sp. (1.9%) and *Strongyloides* sp. (1.9%) (Table 2). Intensity of different parasites in different animals was measured. The mean EPG /CPG were calculated of each of the animal and the ranges were shown in Table 1. The highest CPG (cysts per gram) of *Balantidium coli* was 700 in Zebra. The highest EPG (eggs per gram) of stomach worm (1200) was in Nil Gai. The intensity of other parasites was *Paramphistomum* sp. (700) in Water Buck, *Fasciola* sp. (500), *Strongyloides* sp. (200) in Impala and *Ascaris* sp. (300) in Horse.

Prevalence of mixed infection

Overall prevalence of mixed infection was 42.3%. Mixed infection was observed in the fifteen animals such as Butani cattle, Giraffe, Spotted deer, Sambar deer, Horse, Greater kudu, Nil gai, Black wilde beast, Impala, Hippopotamus, Zebra, wilde beast, one Horned Rhinoceros, common Eland and Oryx. Prevalence of the examined mixed infection were *Balantidium coli* and *Paramphistomum* sp. (26.92%); *Balantidium coli* and *Fasciola* sp. (5.8%); *Balantidium coli* and stomach worm (3.9%); *Balantidium coli* and *Strongyloides* sp. (0.02%); *Balantidium coli* and *Ascaris* sp. (0.02%); *Paramphistomum* sp., *Fasciola* sp. and *Balantidium coli* (0.02%) (Table 3).

Table 1. Name of parasites and intensity of ova/cyst of different parasites in different animals at Dhaka Zoo

Name of the animal	Name of the parasite	No. of positive case (No. of sample)	Prevalence (%)	Intensity of infection (EPG /CPG)
				Ranges
Butani Cattle	*Paramphistomum* sp.	2(2)	100	100-200
	Balantidium coli	2(2)	100	100-400
Asian Elephant	*Balantidium coli*	1(2)	50	400
Giraffe	*Balantidium coli*	2(4)	50	200-300
	Paramphistomum sp.	3(4)	75	100-300
Greater Kudu	*Balantidium coli*	1(2)	50	400
	Paramphistomum sp.	1(2)	50	200
Nil Gai	Stomach worm	1(2)	50	1200
	Balantidium coli	1(2)	50	400
Black Wilde Beast	*Balantidium coli*	2(2)	100	100-300
	Paramphistomum sp.	1(2)	50	200
Gayal	*Paramphistomum* sp.	1(2)	50	200
Spotted deer	*Balantidium coli*	3(6)	50	200-300
	Paramphistomum sp.	2(6)	33.33	100-300
	Fasciola sp.	3(6)	50	200-500
Sambar deer	*Balantidium coli*	3(4)	75	100-300
	Fasciola sp.	3(4)	75	200-400
Water buck	*Paramphistomum* sp.	1(2)	50	700
Impala	*Strongyloides* sp.	1(2)	50	100-200
	Balantidium coli	2(2)	100	100-400
Barking Deer	*Fasciola* sp.	3(4)	75	100-300
Hippopotamus	*Balantidium coli*	2(2)	100	100-400
	Paramphistomum sp.	2(2)	100	100-200
Horse	*Ascaris* sp.	1(2)	50	300
	Balantidium coli	2(2)	100	200-300
Ass	*Fasciola* sp.	1(2)	50	100
Zebra	*Balantidium coli*	1(2)	50	700
	Paramphistomum sp.	2(2)	100	100-200
Chimpanzee	Nil	0(2)		
One Horned Rhinoceros	*Balantidium coli*	2(2)	100	100-400
	Paramphistomum sp.	1(2)	50	200
Wilde Beast	*Balantidium coli*	2(2)	100	200-400
	Paramphistomum sp.	2(2)	100	200-300
	Fasciola sp.	1(2)	50	300
Common Eland	*Paramphistomum* sp.	1(2)	50	300
	Balantidium coli	2(2)	100	200-400
Oryx	Stomach worm	1(2)	50	300
	Balantidium coli	1(2)	50	400

Table 2. Prevalence of parasites in different herbivore animals at Dhaka zoo

Types of parasites	Name of the parasites	No. of case	Prevalence (%)
Protozoa	*Balantidium coli*	29	55.8
Trematode	*Paramphistomum* sp.	19	36.5
	Fasciola sp.	11	21.2
Nematode	Stomach worm	02	3.9
	Ascaris sp.	01	1.9
	Strongyloides sp.	01	1.9

Table 3. Prevalence of mixed infection

Name of the parasites	No. of case	Prevalence (%)
Balantidium coli and *Paramphistomum* sp.	14	26.9
Balantidium coli and *Fasciola* sp	03	5.8
Balantidium coli and Stomach worm	02	3.9
Balantidium coli and *Strongyloides* sp.	1	0.02
Balantidium coli and *Ascaris* sp.	1	0.02
Paramphistomum sp., *Fasciola* sp. and *Balantidium coli*	1	0.02

Diameter of ova or cyst of different gastrointestinal parasites in different Zoo animals

The diameters (length by width) in µm of egg or cyst of different gastrointestinal parasites were measured in the present study. The diameter of *Balantidium coli* (43.5 – 45 x 29 - 35) µm, *Paramphistomum* sp. (160 - 170 x 90 - 95) µm, *Fasciola* sp. (87 x 43.5) µm, *Ascaris* sp. (70 x 50) µm, stomach worm (72.5 x 43.5) µm and *Strongyloides* sp. (58.0 x 29.0) µm in different zoo animals were calculated.

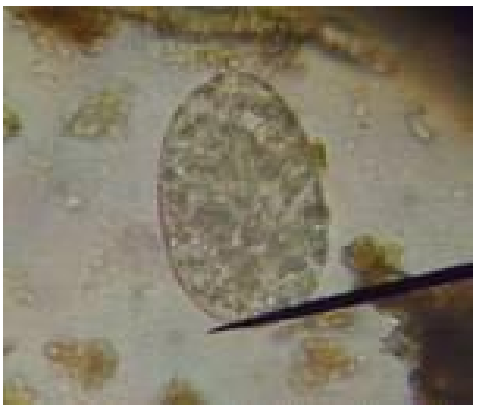

Plate 1. Egg of *Fasciola* sp. of Spotted deer (720X)

Plate 2. Egg of *Strongyloides* sp. of Impala (720X)

Plate 3. Egg of *Paramphistomum* sp. of Butani cattle (720X)

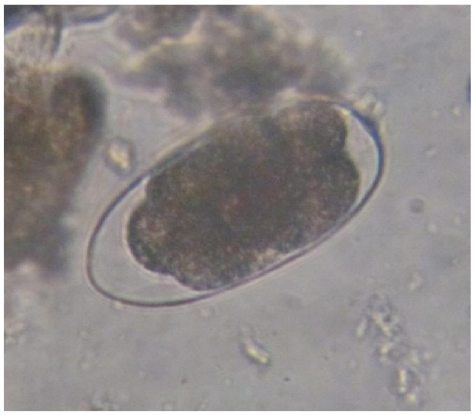

Plate 4. Egg of stomach worm of Oryx (720X)

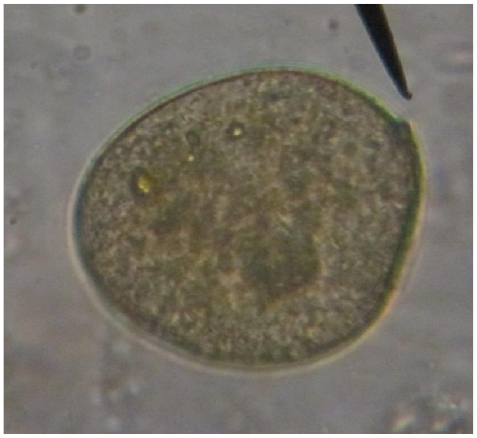

Plate 5. Cyst of *Balantidium coli* of Hippopotamus (720X)

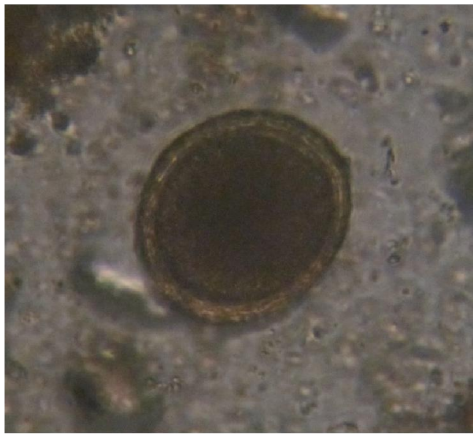

Plate 6. Egg of *Ascaris* sp. of Horse (720X)

Discussion

Overall 76.9% of herbivore animals of Dhaka Zoo were found positive for gastrointestinal parasites, which is similar with the earlier reports of Opara *et al.*, (2010) who revealed 76.6% positive cases. This finding is slightly higher than the report of Corden *et al*., (2008) who observed that the prevalence was 72.5%. On the other hand, the lower prevalence rate than the present study was recorded as 60.7% by Parasani *et al*., (2001), 56.3% by Lim *et al.*, (2008), 48.1% by Modi *et al.*,(1997), 42.4% by Reddy *et al.*, (1992) and 40.4% by Chakraborty and Islam (1996). This may be due to geographic conditions, husbandry practice and source of feeds of the animalwhich influences the prevalence.

The prevalence of helminths infection (65.4%) was found higher than protozoan infection (55.8%). This is similar with the report of Parasani *et al.*, (2001) who revealed that 50% animal's positive for helminths infection and 18.8% for protozoa in Rajkot Municipal Corporation zoo. The present study also confirms the report of Varadharajan and Kandasamy (2000) who recorded that 58% animals were positive for helminths infections and 6% were positive for protozoan infections. On the other hand Opara *et al.*, (2010) recorded the higher prevalence of helminths (82.2%) than protozoa (17.8%). The high occurrence of GIT helminthes which comprised more nematodes, agrees with Rossanigo and Gruner (1995). The high prevalence of helminths encountered in the survey explained by the existence of favorable climatic conditions which support prolonged survival of infective nematode larvae.

The intensity of different parasites in different herbivore animals was calculated and measured in this study. The mean EPG/CPG was not measured in most of the animal due to single sample and also the number of positive case was one or two. So, in case of more than one, the range of lowest and highest intensity was indicated. The intensity of different parasites was similar with the findings of Singh *et al.,* (2009).

The results indicate that 55.8% of animals were infected with *Balantidium coli* followed by *Paramphistomum* sp. (36.5%), *Fasciola* sp. (21.2%), stomach worm (3.9%), *Ascaris* sp. (1.9%) and *Strongyloides* sp. (1.9%). Ruta *et al.,* (2009) found *Strongyloides* sp. (73.3%) and *Paramphistomum* sp. (63.0%) in red deer and fallow deer. Opara *et al*., (2010) observed *Ascaris* sp. and *Fasciola* sp. in different zoo animals. This difference might be due to location of animal cages, availability of intermediate host near the cages and the source of feeds. The probable cause of *Fasciola* sp. infection was strongly connected with mud snails that live on the edges of drain and act as intermediate host (Vengust, 2003). The cage of deer at Dhaka Zoo is located near the lake of Zoo. Another important probable cause was the green grasses and leaves supplied to deer used to take from outside of the Zoo which may be contaminated with metacercaria (Kanungo *et al.,* 2010).

In this study, overall prevalence of mixed infection was 42.3%. Mixed infection was observed in the fifteen animals such as butani cattle, giraffe, spotted deer, sambar deer, horse, greater kudu, nil gai, black wild beast, impala, hippopotamus, zebra, wild beast, one horned rhinoceros, common eland and oryx. Prevalence of mixed infection were *Balantidium coli* and *Paramphistomum* sp. (26.9%); *Balantidium coli* and *Fasciola* sp. (5.8%); *Balantidium coli* and stomach worm (3.9%); *Balantidium coli* and *Strongyloides* sp. (0.02%); *Balantidium coli* and *Ascaris* sp. (0.02%); *Paramphistomum* sp., *Fasciola* sp. and *Balantidium coli* (0.02%). The mixed infection in deer was recorded by Kanungo *et al., (*2010) and Mutani *et al.,* (2003). This suggests that there is a fairly high rate of transmission of the parasites observed between individuals either because of the gregarious nature or because of suitable environmental conditions. The finding of mixed infection in this study might be due to presence of different aged animals in the same cages, feeding management and improper disposal of feces.

The diameter of egg or cyst of different gastrointestinal parasites found in the present study is almost similar with the findings of Hendrix and Robinson (2006), Christensen (1938) and Soulsby (1982). But sometimes differ from the present study e.g. the diameter of egg of *Fasciola* sp. (87 x 43.5 µm.) is comparatively lower than the record of Soulsby (1982) who measured as 130-150 x 63-90µm. On the other hand, the result of present study revealed that the diameter of cyst of *Balantidium coli* was same in Deer and Hippopotamus (43.5 x 29.0µm.). But Hendrix and Robinson (2006) indicated the diameter of cyst of *Balantidium coli* is 40-60 µm. This variation of size with the previous findings might be due to the method of measurement, strains of the parasite, species of the host and climatic factors.

Conclusion

Gastrointestinal parasites are highly prevalent in herbivores of Dhaka Zoo. The present study provided a partial concept regarding parasitic infection of captive animals of Dhaka Zoo and also helps to find out the effective control measure, which is necessary to safeguard the health of Zoo animals.

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