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RESEARCH ARTICLE
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Prevalence of gastro-intestinal parasites in captive wild animals of Nandan Van Zoo, Raipur, Chhattisgarh

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Abstract

Aim: Zoological gardens exhibit wild animals for aesthetic, educational and conservation purposes. Parasitic diseases constitute one of the major problems causing morbidity and even mortality in captive wild animals. The aim of the present study was to assess the prevalence of gastro-intestinal parasites in captive wild animals belonging to Nandan Van Zoo, Raipur district, Chhattisgarh.

Materials and Methods: A total of 210 faecal samples were screened from apparently normal/healthy captive wild animals from various enclosures of the zoo. Samples were tested using sedimentation and sugar floatation techniques.

Result: Microscopic examination of faecal samples revealed 46.2% (97) prevalence of gastro-intestinal parasites in captive wild animals. Prevalence of GI parasites was higher in primates (60%) followed by herbivores (45.6%) and carnivores (45.2%).

Conclusion: Our study suggests that among different helminthic infections, the prevalence of nematodal infection was higher than cestodal infection. Majority of captive wild animals had mixed infection of *Toxocara sp.* and *Diphyllobothrium sp.* There is a need of detail epidemiological investigation on prevalence of gastro-intestinal parasites in captive wild animals in respect to season, age, climate etc.

Keywords: captive wild animals, gastro-intestinal parasites, Nandan van, prevalence.

Introduction

India is unique in having immense natural beauty and possessing a rich and diverse wildlife. A number of factors threaten the existence of wild animals in this country, including wildlife diseases, in particular those arising from gastrointestinal parasites. Zoological gardens exhibit wild animals for aesthetic, educational and conservation purposes. Helminthic infections in particular can frequently be a major problem causing even mortality in captive wild animals [1]. In the wild, animals might have a natural resistance against parasitic infections or live in a balanced system with their parasites. 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 [2]. Little work has been done to understand the epidemiology of different parasitic diseases in wild animals kept in Indian zoos [3- 7]. The parasites cause a multitude of problems for wildlife and although it often appears that wildlife have adapted to the presence of parasites, they have not adapted to the adverse effects of parasitism [8]. Confined areas in zoo enclosure makes captive animals more prone to different parasitic infections despite proper attention to feeding, water and maintenance of hygiene in captivity [9].

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. Through these proximate mechanisms, parasites can potentially regulate host populations [10]. Information on parasitic infections of wild animals is meagre due to paucity of systematic investigation [11]. In addition, some parasites are zoonotic and pose a risk to human health [12, 13]. Systematic investigation of parasitic diseases of wildlife is still in its infancy in India and data are still on the base line [14].

There appears to be no report on the prevalence of gastro-intestinal parasites in captive wild animals in Chhattisgarh. Keeping that in view the present work was undertaken to study the prevalence of gastro-intestinal parasites in captive wild animals of Nandan Van Zoo, Raipur.

Materials and Methods

Ethical approval: The study was conducted after the approval of the Institutional Animal Ethics Committee.

Samples: A total of 210 freshly passed pooled faecal samples of different captive wild animals *viz.* lion (*Panthera leo*), leopard (*Panthera pardus*), tiger (*Panthera tigris*), bear (*Melursus ursinus),* hyaena (*Hyaena hyaena*), jackal *(Canis aureus),* ratel (*Mellivora*

Table-1: Prevalence of gastro-intestinal parasitic infection in captive wild animals of Nandan Van Zoo, Raipur

Type of animals (Host)	No. of animals examined	No. of samples positive for GI parasites	Samples showing single infection	Samples showing mixed infection	Type of of infection	Intensity of infection	EPG
Carnivores							
Lion (*Panthera leo*)	8	3	2	1	*Toxocara* spp. *Diphyllobothrium* spp.	+ to +++	200-1800
Leopard (*Panthera pardus*)	8	2	-	2	*Toxocara* spp. *Diphyllobothrium* spp.	++ to +++	600-1600
Tiger (*Panthera tigris*)	3	Nil	-	-	-	-	-
Bear (*Melursus ursinus)*	6	4	4	-	*Toxocara* spp.	++ to +++	900-1200
Hyaena (*Hyaena hyaena*)	3	2	2	-	*Diphyllobothrium* spp.	+ to ++	400-600
Jackal *(Canis aureus)*	2	2	2	-	*Toxocara* spp.	+ to ++	400-700
Ratel (*Mellivora capensis*)	1	1	-	1	*Toxocara* spp. *Diphyllobothrium* spp.	+ to ++	300-1000
Herbivores							
Barking deer (*Muntiacus muntjak*)	6	6	6	-	*Ascaris* spp.	+	100-300
Chausingha (*Tetracerus quadricornis*)	10	8	8	-	*Ascaris* spp.	+	100-300
Spotted deer (*Axis axis*)	100	38	38	-	*Ascaris* spp.	+	100-300
Blue bull (*Boselaphus tragocamelus*)	7	6	6	-	*Ascaris* spp.	+	100-300
Black buck (*Antilope cervicapra*)	40	14	14	-	*Ascaris* spp.	+	100-300
Sambar (*Cervus unicolor*)	6	5	5		*Ascaris* spp.	+	100-300
Primates							
Rhesus macaque (*Macaca mulatta)*	10	6	6	-	*Toxocara* spp.	+	100-300

capensis), barking deer (*Muntiacus muntjak*), chausingha (*Tetracerus quadricornis*), spotted deer (*Axis axis*), blue bull (*Boselaphus tragocamelus*), black buck (*Antilope cervicapra*), sambar (*Cervus unicolor*) and rhesus macaque (*Macaca mulatta)* kept at various enclosures of Nandan Van Zoo, maintained by the forest department of Chhattisgarh were collected in a clean, dry and individually labelled polythene bags [15]. The faecal samples were brought to the laboratory for qualitative examination using sedimentation and sugar floatation techniques and quantitative examination by Stoll's dilution technique for eggs per gram (EPG) to assess the intensity of different helminthic infections. The level of severity of infection was graded into three categories basing on EPG of faeces *viz*; below 500 (+), between 500 to 1000 (++) and more than 1000 (+++) [16].

Floatation method: This method was mostly useful for the examination of eggs of nematodes. 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. The filtrate was poured into a centrifuge tube and centrifuged at 2000 rpm for 5 minutes. The supernatant was discarded and tube was again refilled with water and centrifuged 2-3 occasions until the supernatant was cleared. The sediment was then mixed with saturated sugar solution (10ml) in a centrifuge tube and again centrifuged. 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: This method was mostly useful for the examination of eggs of trematodes and cestodes. 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 2000 rpm for 5 minutes. The supernatant was discarded and tube was again refilled with water and centrifuged 2-3 occasions until the supernatant was cleared. Then a drop of the sediment was taken on a clean, dry glass slide and examined under low power (10X) of the microscope.

Stoll's dilution technique: About 3 grams of faeces from thoroughly crushed and mixed whole faecal pellets was taken in a stoppered graduated flask to which N/10 NaOH solution was added up to 45 ml mark. After adding 10-12 glass beads, the flask was 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 was counted under low power objective (10X) of the microscope. The number of eggs per gram of faeces was determined by using the formula: EPG = Number of eggs x 100 (where 100 is the dilution factor).

The prevalence of gastro-intestinal parasites in captive wild animals was recorded with respect to captive wild carnivores, herbivores and primates.

Results

The prevalence of gastro-intestinal (GI) parasitic infections in different captive wild animals is presented in Table-1. Out of 210 faecal samples examined, 97 were found positive for different helminth parasites, indicating 46.2% prevalence of GI parasites. Among different helminthic infections in captive wild animals, the prevalence of nematodes and cestodes was 97.94%

and 8.24%, respectively. Among different captive wild animals, the prevalence of GI parasites was 45.2% in carnivores, 45.6% in herbivores and 60% in primates, indicating higher prevalence of GI parasites in primates than carnivores and herbivores in zoo. Among carnivores the highest prevalence of GI parasites was recorded in jackals and ratels (100%) followed by bears and hyaenas (66.67%), 37.5% in lions and 25% in leopards.

In the present study, we observed that carnivores except bears, jackals and hyaenas had mixed infection of *Toxocara* spp. and *Diphyllobothrium* spp. Bears and jackals had single infection of *Toxocara* spp. and hyaenas had single infection of *Diphyllobothrium* spp. The severity of infection in captive wild carnivores was mild to severe as revealed by EPG which ranged from 200-1800. Among carnivores, moderate to severe infection was recorded in leopards, bears and lions whereas in rest of carnivores the infection was mild to moderate. Among herbivores, barking deers showed highest prevalence (100%) of GI parasites followed by blue bulls (85.71%), sambers (83.33%), chausinghas (80%), spotted deers (38%) and black bucks (35%). Infected herbivores had single infection of *Ascaris* spp. and single infection of *Toxocara* spp. was found in rhesus macaques. In captive wild herbivores and primates the EPG varied from 100-300 indicating mild infection.

Discussion

The prevalence of GI parasites has been reported from a number of zoos in different states by previous workers like Ghoshal *et al.* [17] in Kamla Nehru Park, Indore, India; Varadharajan and Pythal [18] in Zoological Garden, Thiruvananthapuram, Kerala, India; Patel *et al.* [19] in zoological gardens of Gujarat, India; Deshmukh *et al*. [20] in Van Vihar National Park, Bhopal, India.

The present findings in respect to prevalence of GI parasites of captive wild animals was in agreement with earlier reports of Elbakery [21] which indicated the management practices of captive wild animals of Nandan Van Zoo in general was at par with some other zoos of India. Carnivores of the Nandan Van Zoo like lions, leopards, bears, and jackals were positive for *Toxocara* spp. infection. Similar findings have also been reported by Shrikhande [22] and Sahoo [23] .The single infection of *Ascaris* spp. was recorded in all herbivores of the zoo. The present findings differ from the report of Singh [24] who recorded *Strongyles* infection as the most commonly detected parasitic infection (89%) in wild herbivores in the Mahendra Choudhury zoological park, Chhatbir, Punjab. The prevalence of parasitic infection in rhesus macaques under primate category was 60%. Above findings are not in agreement with the report of Bante [25] who reported a higher prevalence of parasitic infection in monkeys (89.47%) and langurs (66.66%). On the contrary, Reddy *et al* [26] reported 0% prevalence of GI parasites in rhesus monkeys from Bangalore. Chakraborty and Goswami [27] however reported mixed infection of *Ancylostoma* spp., *Trichuris* spp. *and Enterobius* spp. in rhesus monkeys which did not conform with the present findings. Low intensity (100-300 EPG) of GI parasitic infections in primates might be attributed to better management practices in Nandan Van Zoo.

The nematodes parasites have direct life cycle and do not involve any intermediate host and are transmitted by faecal contamination of feed, water and soil. Some helminths potentially accumulate in a captive environment especially in open soil enclosure which cannot be easily disinfected. The survivability of the helminth parasites is highly influenced by climatic factors. Other parasites, mainly trematodes and some cestodes require an intermediate host for their transmission and are less likely to accumulate in the captive environment [28]. Present findings are also in accordance with the above report that helminthic infections like nematodes and some cestodes recorded in present studies were geo-helminths and do not require an intermediate host. That is why the prevalence of nematodes was higher among all the helminths.

In order to detect the severity of parasitic infection, EPG level will be helpful in knowing the amount of infection the animal is suffering from. In comparison to domestic animals, the captive animals do not show any alarming signs of parasitic infections [29]. Parasitism, especially endoparasitic infection produces ill effects such as weakness, emaciation, inappetance and predisposes the animals to various potential pathogens. It has been reported that regular faecal examination for parasitic ova/larva along with assessment of parasitic load and administration of desired anthelmintics, when warranted, at regular intervals would be able to curtail parasitic infection in captive wild animals. Quarantine measures for parasitic disease control need to be standardized in all the Indian zoos.

Conclusion

We conclude that the prevalence of GI parasites in captive wild animals of Nandan Van Zoo was 46.2%. Among different helminthic infections, the prevalence of nematodes was higher than cestodes. Among captive wild animals the prevalence of GI parasites was higher in primates (60%) followed by herbivores (45.6%) and carnivores (45.2%). Majority of captive wild animals had mixed infection of *Toxocara* spp. and *Diphyllobothrium* spp. There is a need for detail epidemiological investigation on the prevalence of gastro-intestinal parasites in captive wild animals with respect to season, age, climate etc. Based on the prevalence of gastro-intestinal parasites and administration of desired antihelminthics to the captive wild animals periodically coupled with better sanitary measures, we would be able to reduce the parasitic infection in the zoos.

Authors' contributions

SKM and AAD designed the experiment, sample

collection and Experiment was performed by VKT under supervision of SKM. Manuscript preparation was supervised, reviewed and edited by SKM and AAD. All authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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