The epidemiology of gastrointestinal parasitism and body condition in free-ranging herbivores

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India is rich in unique and diverse wildlife. A number of factors threaten the existence of wild animals in this country, including wildlife diseases and disorders arising from gastrointestinal parasites. The diagnosis of these parasites can be made by faecal sample examination. The physical status and health of wild animals can be judged by evaluation of their body condition, which can be done from a safe distance without disturbing the animals.

The present work was planned to study the prevalence of gastrointestinal parasitic infections, assess pasture contamination by infective parasitic stages, judge body condition of free ranging wild herbivores; Chital or Spotted Deer (*Axis axis*), Sambar (*Rusa unicolor*) and Nilgai or Blue Bull (*Boselaphus tragocamelus*) and study general condition and management practices in the Van Vihar National Park, Bhopal. The Park lies at the eastern bank of Bhopal big lake. The big lake thus affects the local micro climate of this area by lowering temperature 1 to 1.5°C. The area therefore is relatively more humid than other areas of the town. The annual average temperature recorded so far was 25.1°C. The average rainfall of the area was 1128.9mm. The animals are present in free range as well as managed in captivity, giving it the status of both National Park and Zoological Park (Chandra et al. 2000). Free ranging animals include Chital, Sambar, Nilgai, Jackal, Wild Boar, common langur etc., whereas the captive animals are Black Buck, Chinkara, tiger, lion, leopard, Striped Hyaena, Sloth Bear etc.

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Methods

The present study was carried out for a period of one year (2005-06) in three distinct seasons i.e. winter (November to February), summer (March to June) and rainy (July to October). It was comprised of faecal sample analysis, evaluation of body condition of free ranging herbivores and study general condition and management practices in the park.

Analysis of faecal samples - About 5-20 g of freshly laid faecal samples were collected in interlocked polythene bags. Additionally, a small part of the same faecal sample was collected in plastic collection bottles containing 10% formalin. The faecal samples collected in polythene bags were refrigerated until examination. The samples were examined on the basis of qualitative and quantitative estimation techniques. Qualitative estimation was made by Sheather's sugar flotation technique to screen the nematode eggs and protozoan oocysts, and a faecal sediment technique to screen fluke eggs (Sloss et al. 1994). Quantitative estimation was done by employing the Modified McMaster egg counting technique to determine nematode eggs/coccidia oocysts per gram (EPG/OPG), and Stoll's dilution technique to determine fluke eggs per gram (EPG) of faeces (Soulsby 1982).

Body condition evaluation - Body condition of animals was evaluated on point scale as suggested by Riney (1960) and modified by Shrivastav & Sharma (2000).

Study related to general condition and management practices in the park was done by direct observation and from secondary sources.

Data were subjected to standard statistical analysis to calculate mean, standard deviation and standard error (Snedecor & Cochran 1967).

Result and Discussion

The overall rate of parasitic prevalence was 38.17% (Table 1). The moderate temperature range and more humidity conditions of the Park might have induced the 'mat' formation between the soil and the herbage favorable to the survival of eggs and free-living stages of parasites. This can be further supported by the findings of Mondal et al. (2000), who documented that grasslands are one of the main sources of gastrointestinal parasitic diseases to animals. The parasitic prevalence was highest (39.45%) in Sambar, followed by Chital (38.19%) and Nilgai (36.84%) (Table 1). Sambar take to water readily and swim with the body submerged, which might have exposed them to infective stages of parasites leading to higher parasitic prevalence in the species. The highest prevalence was recorded for strongyles (26.15%) followed by *Strongyloides* sp. (7.13%), coccidia (6.20%), *Fasciola* sp. (2.64%), amphistomes (1.98%) and *Trichuris* sp. (1.84%) (Image 1). Chakraborty & Islam (1996) performed study in wild herbivores at Kaziranga National Park and recovered the eggs of strongyles,

Strongyloides sp., *Ascaris*, *Paramphistomum*, *Fasciola* and oocyst of coccidia. Gaur et al. (1979) recorded maximum prevalence of strongyles (20.25%), followed by *Fasciola* sp. (16.46%), *Strongyloides* sp. (15.19%) and amphistomes (12.66%) at Corbett National Park. Mandal et al. (2002) also reported maximum infection of strongyles (41.67%), followed by amphistomes (15.63%), *Fasciola* sp. (13.54%), *Strongyloides* sp. (11.46%) and *Ascaris* sp. (5.29%) in wild herbivores at Mudumalai Wildlife Sanctuary.

During the present survey the prevalence of trematodes (*Fasciola* sp. and amphistomes) was recorded to be comparatively lesser than reported by other workers (Gaur et al. 1979; Chakraborty & Islam 1996; Mandal et al. 2002). The variation in topography of the Protected Area appears to influence the rate of prevalence. The aforementioned studies were conducted in hillocks and swampy meadows, where the snail population which serves as intermediate host for flukes is abundant around natural water sources, facilitating higher concentration of metacercaria, the infective stage. The prevalence of parasitic infection in all the three species was highest in the rainy season, followed by winter and summer. The findings are in accordance with Modi et al. (1997), and Kumar & Rao (2003) who also documented maximum prevalence (51.9% & 46.59%, respectively) in wild animals during the rainy season. The higher rate of prevalence during the rainy season is due to the existence of a suitable microclimate for the survival and propagation of free-living larval stages of parasites at several places. The parasitic ova, snails and other intermediate host get a favorable humid sub-tropic climate for development in the plane grazing areas with shallow temporary stagnated water. The animals congregate at the greens available around the periphery of such areas and naturally acquire more infection. The overall mean EPG was maximum for strongyles (585.19) followed by *Trichuris* (410), amphistomes (250), *Strongyloides* (127.78) and *Fasciola* (111.19). Overall mean OPG for coccidia was 1655. The Sambar showed maximum load for the parasitic eggs of strongyles (666.67±66.67), *Strongyloides* (133.33±47.14), *Trichuris* (500±100), amphistome (300±57.74) and coccidia (1990.00±99.24). Only *Fasciola* eggs were maximum (128.57±28.57) in Nilgai (Table 2). The findings indicated high pasture contamination by various parasites.

The body condition evaluation revealed 42.22% animals in good, 41.11% in average and 16.67% in poor body condition. Species-wise percentage of animals in good body condition was maximum for Nilgai (46.67%) followed by Chital (43.33%) and Sambar (36.67%) (Table 3).

The factors which affect development and survival of infective stages are mainly environmental, especially seasonal climatic change and management practices (Urquhart et al. 1996). The number of free ranging animals at Van Vihar National Park was more and scarcity of natural foodstuffs was seen during the summer season. This was inducing the animals to graze closer to faeces than otherwise, enhancing the chances of acquiring infective stages. The more number of animals was further hastening the spread of infective parasitic stages among them. Overgrazing of palatable grasses; resulted in faster development of obnoxious weeds i.e. Parthenium and Lantana. The ungulates were observed consuming these weeds. The green fodder, wheat straw, gram husk, mineral and licks were supplemented to cope with stressful atmospheric conditions

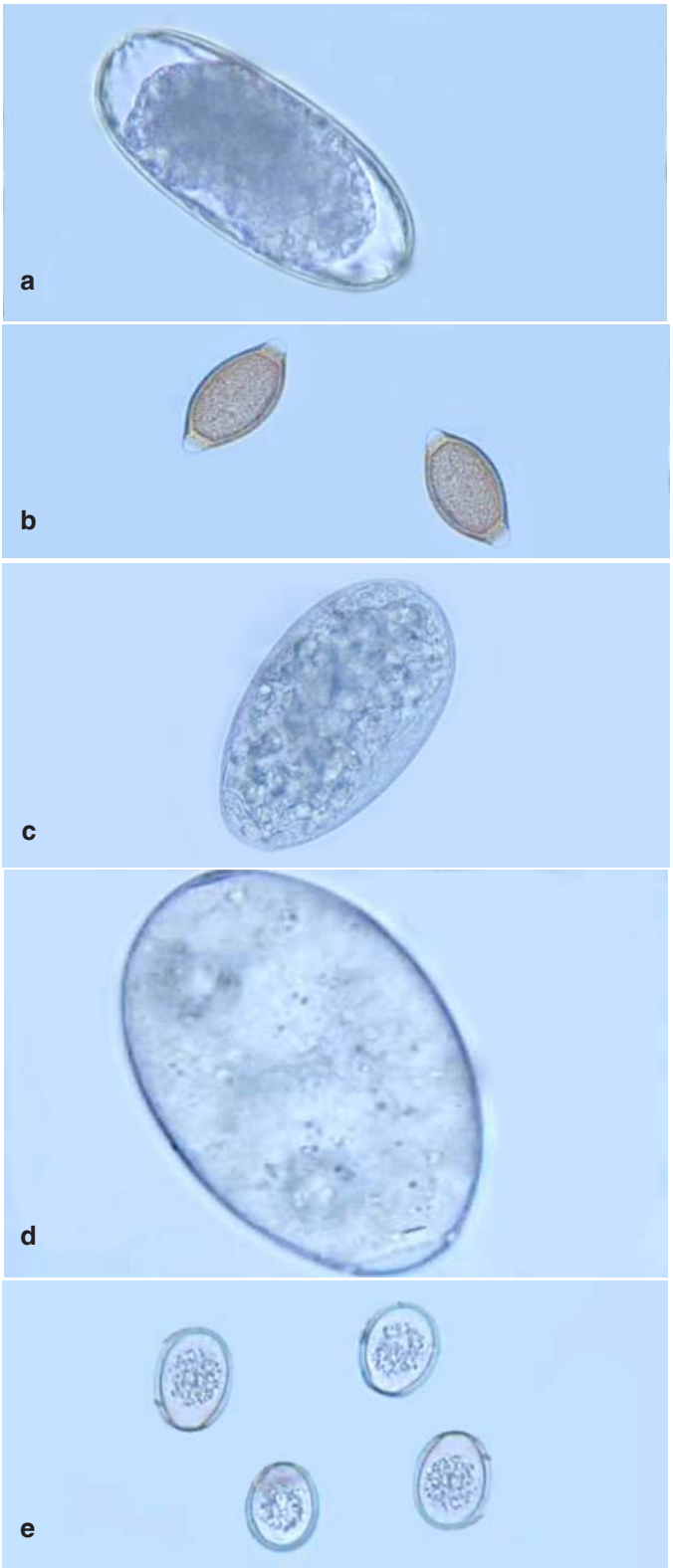

Image 1. Photomicrographs showing eggs of parasites in different animals
(a) Strongyle egg recovered from Chital pellets. X 400
(b) *Trichuris* sp. eggs recovered from Sambar pellets. X 400
(c) *Fasciola gigantica* egg recovered from Sambar pellets. X 400
(d) Amphistome egg recovered from Nilgai pellets. X 400
(e) Unsporulated oocyst of coccidia recovered from Nilgai pellets. X 400

Table 1. Prevalence of parasitic infection in free ranging herbivores

Animal species	Season	Number examined	Number infected	Percentage infection	Strongyle (%)	*Strongyloides* (%)	*Trichuris* (%)	*Fasciola* (%)	Amphistome (%)	Coccidia (%)
Chital	Winter	110	44	40	33 (30)	8 (7.27)	0	2 (1.81)	1 (0.9.)	5 (4.54)
	Summer	78	21	26.92	16 (20.51)	4 (5.12)	0	1 (1.28)	1 (1.28)	3 (3.84)
	Rainy	66	32	48.48	21 (31.81)	6 (9.09)	0	3 (4.54)	2 (3.03)	6 (9.09)
	Total	**254**	**97**	**38.19**	**70 (27.55)**	**18 (7.08)**	**0**	**6 (2.36)**	**4 (1.57)**	**14 (5.51)**
Sambar	Winter	116	45	38.79	29 (25)	7 (6.03)	0	3 (2.58)	3(2.58)	6 (5.17)
	Summer	71	18	25.35	14 (19.71)	4 (5.63)	0	0	0	3 (4.22)
	Rainy	69	38	55.07	20 (28.98)	6 (8.69)	5 (7.24)	3 (4.34)	4 (5.79)	8 (11.59)
	Total	**256**	**101**	**39.45**	**63 (24.60)**	**17 (6.64)**	**5 (1.95)**	**6 (2.34)**	**7 (2.73)**	**17 (6.64)**
Nilgai	Winter	101	41	40.60	28 (27.72)	8 (7.92)	4 (3.96)	4 (3.96)	2 (1.98)	7 (6.93)
	Summer	82	20	24.39	17 (20.73)	4 (4.87)	0	1 (1.21)	0	4 (4.87)
	Rainy	64	30	46.87	20 (31.25)	7 (10.93)	5 (7.81)	3 (4.68)	2 (3.12)	5 (7.81)
	Total	**247**	**91**	**36.84**	**65 (26.31)**	**19 (7.69)**	**9 (3.64)**	**8 (3.23)**	**4 (1.61)**	**16 (6.47)**
Grand total		**757**	**289**	**38.17**	**198 (26.15)**	**54 (7.13)**	**14 (1.84)**	**20 (2.64)**	**15 (1.98)**	**47 (6.20)**

Table 2. Overall mean EPG/OPG of parasites in free ranging herbivores

Species	Strongyles	*Strongyloides*	*Trichuris*	*Fasciola*	Amphistomes	Coccidia
Chital	600 ± 94.28	125 ± 52.61	—	80.00 ± 37.42	250 ± 50	1875.00 ± 196.53
Sambar	666.67 ± 66.67	133.33 ± 47.14	500 ± 100	125 ± 47.87	300 ± 57.74	1990.00 ± 99.24
Nilgai	488.89 ± 58.79	125 ± 52.61	320 ± 101.98	128.57±28.57	200 ± 115.47	1100.00 ± 1100
Average	**585.19**	**127.78**	**410**	**111.19**	**250**	**1655**

Table 3. Body condition of free ranging herbivores

Species	Number Examined	Body condition Good (%)	Average (%)	Poor (%)
Chital	30	13 (43.33)	12 (40)	5 (16.67)
Sambar	30	11 (36.67)	13 (43.33)	6 (20)
Nilgai	30	14 (46.67)	12 (40)	4 (13.33)
Total	**90**	**38 (42.22)**	**37 (41.11)**	**15 (16.67)**

(Chandra et al. 2000).

The Nilgai were in far better body condition in comparison to Chital and Sambar. The lower parasitic load, ability to sustain stressful conditions and lower number of Nilgai might be the reason for their good physical condition. In contrast, a higher parasitic prevalence and population along with other incompatible conditions might have resulted in the lowered body condition in Chital and Sambar.

The chances of acquiring parasitic infection around waterholes can be controlled by suitable physical, chemical and biological methods. Rotational cropping of pastures can reduce the influence of mat formation and therefore parasitic survival. Use of regular pasture and habitat improvement along with rotational grazing practices may be followed to improve host nutrition and help maintain their resistance to parasitism in a natural manner. Large scale eradication of the weeds should be carried out on a priority basis.

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