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Parasites Behind Bars: The Hidden Burden of Gastrointestinal (GI) Helminths in Captive Mammals in Sri Lanka

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ABSTRACT

Gastrointestinal (GI) helminths pose a significant health threat to captive mammals, particularly in zoological settings where crowding, shared enclosures, and environmental contamination facilitate parasite transmission. This study examines the prevalence and potential risk factors of GI helminth infections in 40 mammal species from 8 taxonomic orders at the Dehiwala National Zoological Garden, Sri Lanka. Faecal samples were analysed using modified salt flotation technique to identify helminth species. Binary Logistic Regression was performed to assess the association between food habit, water source, and helminth prevalence. The overall GI helminth prevalence was 37.5%, with carnivores exhibiting the highest prevalence (81.8%), while Perissodactyla, Lagomorpha, and Proboscidea showed no infections. Strongyle sp. was the most prevalent parasite (80%), followed by Ascaris spp. and Bertiella spp. (13% each), and Toxocara spp. (2.5%). Binary logistic regression revealed that food type is a significant contributor of parasitic infection. Carnivorous species exhibited significantly higher odds of infection compared to omnivores (OR=22.721, p<0.01). However, the water source was not found to be a significant contributor of parasitic helminths among the captive animals (OR = 4.244, p = 0.095.) Captive mammals at the Dehiwala National Zoological Garden exhibit a substantial gastrointestinal helminth burden, with carnivorous species showing significantly higher infection rates. Diet emerged as a key risk factor, while routine deworming every three months proved insufficient in controlling persistent infections. These findings highlight the need for more effective, species-specific parasite management strategies. Parasite control should be tailored to species and dietary habits, with special attention to Carnivores. Meat-based diets must be handled and sourced hygienically to reduce parasite exposure. Faecal examinations should be conducted more frequently and extensively. High-risk groups require intensified interventions, while low-risk orders should remain under regular surveillance.

KEYWORDS: *Captive mammals, Gastrointestinal (GI) helminths, Zoo epidemiology, Parasite prevalence, Risk factors*

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1 INTRODUCTION

Zoological gardens play a vital role in ex-situ conservation, serving as a means to protect endangered species while promoting public education and awareness about wildlife and conservation efforts (Aviruppola, Rajapakse and Rajakaruna, 2016; Schieber and Štrkolcová, 2019). Such like establishments help to secure an environment for endangered species where they can reproduce, thrive and maybe reintroduce to their own natural habitats. Other than that, zoological gardens provide contributions to the fields through similar research and help to understand the biology of species' behavior, and habitat requirements, which further support global conservation initiatives. Additionally, zoos engage in public outreach through educational programs, interactive exhibits, and guided tours, fostering a deeper appreciation for biodiversity and encouraging visitors to participate in conservation activities. Zoos and botanical gardens are instrumental in safeguarding endangered species and ecosystems worldwide as centres for research, education, and conservation.

According to Esteban-Sánchez *et al.* (2024), the confined and restricted habitats in zoological gardens with limited spaces and low mobility may result in thriving parasitic infections. The chances of getting parasitic transmission by animals via direct contacts in shared living spaces are generally high. Few studies have indicated that captive animals infected with more parasitic infections compared to their wild counterparts (Fernando and Udagama-Randeniya, 2009; Schieber and Štrkolcová, 2019). Moreover, according to the same study, factors such as management practices, disease prevention measures, food and water sources, and the frequency of enclosure cleaning significantly influence the prevalence of parasitic infections. Another study suggested that regular deworming protocols can help mitigating these infections to some extent (Goossens *et al.*, 2005; Nath, Islam and Chakraborty, 2012; Sangpeng *et al.*, 2023). According to previous studies, parasitic diseases in captive animals can be introduced through various vectors, including contaminated fruits, vegetables, meat, or fish (Dorny *et al.*, 2009), newly acquired animals carrying parasites, intermediate and paratenic hosts (e.g., insects, rodents), and even infected zoo staff or visitors (Nath, Islam and Chakraborty, 2012).

Mammals, in particular, are known to host a wide range of helminth species. Common gastrointestinal (GI) parasites found in captive animals worldwide include helminths such as *Strongyles spp., Trichuris spp., Nematodirus spp.*, *Toxocara sp.,* and *Moniezia sp.* An overall infection rate of 62.6% was discovered in the study that was conducted among 147 captive mammals at Khon Kaen Zoo in Thailand. Carnivores, Rodents, Primates, and Herbivores were the groups most impacted. The most common Helminths were hookworms and *Strongyloides* species. The results showed that the environmental exposure and stress associated with captivity highly increase the vulnerability to parasitic infections (Sangpeng *et al.*, 2023).

A review article summarizing 29 GI parasitic diseases in mainland China in captive wild mammals emphasized that nematodes were the most prevalent infection, with high rates, especially among primates. A recent research project done in mainland China, investigated parasitic infections in a variety of captive species at Rabat Zoo and discovered nematodes were the most common, with an infection rate of 70%. This study showed that the first occurrence of *Capillaria* spp. in Fennec foxes, and the highest positivity rate was found in Artiodactyls. In order to protect animals and human health in zoo settings, the study highlighted the significance of regular fecal diagnostics, species-specific deworming procedures, and enhanced hygiene practices (Taki and Bourquia, 2024). Moreover, other studies done in India and China suggest that in order to lower the risk of infection in zoological settings, good sanitation, appropriate enclosure management, and regular antiparasitic treatment are significantly contributing (Nath, Islam and Chakraborty, 2012); Zhang *et al.*, 2025).

In Sri Lanka, the studies done in captive animals are largely confined to domestic animals with an economical significance which includes goats, cattle, dogs, cats. Most common parasites identified in goats and cattle include *Strongyles, Ascaris, Trichuris*, and *Moniezia* (Rajakaruna and Warnakulasooriya, 2011; P.B.C.S, Maduwanthi G.Mohomed and M R Fathima, 2024) Whereas the most studied captive wild animal in Sri Lanka is elephants reporting more *Strongyle*s infections (S. Abeysinghe, *et al.*, 2017). The Dehiwala National Zoological Garden, established in the early 1900s, is one of the oldest zoos in Asia housing native and exotic wildlife. Located in the city of Colombo, Sri Lanka, it plays a significant role in wildlife conservation and provides the public with an opportunity to observe a diverse array of animal species (Fernando and Udagama-Randeniya, 2009; Aviruppola et al., 2016). Previous studies conducted at the Dehiwala Zoo have revealed the presence of various GI parasites. For instance, a study examining fecal samples from 15 primate species and identified protozoans such as *Cryptosporidium* sp., *Balantidium* sp., *Blastocystis* sp., *Entamoeba* sp., and *Giardia* sp., as well as nematodes like hookworm larvae and eggs of *Ascaris* sp., *Strongyle* sp., and *Trichuris* sp. (Gunasekera *et al.*, 2012).

Another survey of 19 reptile species found that 62% were infected with parasites, primarily intestinal parasites such as Cestodes, Nematodes, and Protozoans, with four new host-parasite records documented (Fernando and Udagama-Randeniya, 2009). A comprehensive coprological study conducted in 2014 at the Dehiwala National Zoological Gardens assessed the prevalence and diversity of GI parasites in captive mammals (Aviruppola, Rajapakse and Rajakaruna, 2016). Of the 70 samples analyzed, 62.9% tested positive for GI parasites, with 13 different parasite species identified. Helminth infections were more prevalent (81.8%) than protozoan infections (47.7%). Aviruppola et al. in 2016 showed that there was no significant difference

between the parasitic infection rate in captive bread, imported or wild caught animals. According to the study, even though the regular deworming was conducted, the captive animals were still showing considerable amounts of GI parasites (Aviruppola, Rajapakse and Rajakaruna, 2016). Moreover, the study revealed that the urge for regular monitoring of GI parasites and targeted parasite control strategies in captive environments also highlights the need for changes in deworming programs alongside routine veterinary care.

The current study was designed to address two primary objectives: to determine the prevalence and abundance of gastrointestinal helminth infections in captive mammals at the National Zoological Garden, and to investigate potential correlations between helminth infections and 6food sources. Additionally, the study evaluated food habits and water sources to identify factors that may contribute to parasitic infections.

2 RESEARCH METHODOLOGY

2.1 Study Site and Study Period

This study was conducted on captive mammals at the Dehiwala Zoological Garden, Sri Lanka, between September 2023 and February 2024. The Dehiwala Zoological Garden is a prominent zoo featuring a diverse collection of 70 mammal species, categorized into 18 Primates, 19 Carnivores, 6 Perissodactyls, 18 Artiodactyls, 2 Proboscideans, 1 Erinaceomorpha, 1 Lagomorph, and 1 Diprotodont (Figure 1). For this study, 40 mammal species were randomly selected from these categories (Table 1).

A total of 120 fecal samples were collected from 40 selected mammal species during the study period. The animals were housed in enclosures managed by animal caretakers, although specific details regarding the enclosure types (open, closed, or semi-open) were not recorded.

Figure 1. Detailed guide map of Dehiwala zoo with animal locations and facilities

The animals were regularly monitored by the caretakers and treated by veterinarians when necessary.

2.2 Institutional Permission

All procedures were reviewed and approved by zoo authorities before conducting the research. A non-invasive method was used during the collection of fecal samples where droppings were collected from the animal cages with the help of animal caretakers.

2.3 Study animals, sample collection, and preservation

A total of 120 fecal samples were collected from 40 mammal species at the Dehiwala Zoological Garden two weeks after the mammals underwent deworming (Table 1). To assess temporal fluctuations in parasite load, samples were collected at two-month intervals over a six-month period. For species housed in enclosures containing multiple individuals, it was often difficult to identify and resample the same animal; therefore, samples were taken from the same enclosure but not necessarily from the same individual each time. In contrast, for species represented by a single individual, samples were consistently obtained from that same animal during all three sampling events. Sampling occurred opportunistically between 6:00–7:30 AM, prior to enclosure cleaning, with assistance from animal caretakers. Fresh fecal material was visually inspected for abnormalities (e.g., blood, mucus, tapeworm segments). 5–10 g of fecal matter was collected from the interior of samples using disposable spoons, placed into labelled zip-lock bags, and marked with the mammal's name, date, time, and enclosure location. Samples were immediately stored at 4°C, transported to the Zoology research laboratory, The Open University of Sri Lanka on the day of collection, and analyzed within 48 hours to ensure reliability. Data on deworming, food and water provided were noted down with the help of animal caretakers.

Table 1. The sampled animal species during the parasitological survey

Order	Species
Perissodactyla	Wild horse - *Equus przewalskii,* Black rhino - *Diceros bicornis,* Zebra - *Equus sp.*
Artiodactyla	Dual-humped camel - *Camelus sp.* Nilgai -*Boselaphus sp.* Spotted deer - *Axis axis* Buffalo - *Syncerus sp.* Pygmy hippopotamus - *Cheropsis sp.* Nile hippopotamus - *Hippopotamus amphibius,* Sambar - *Cervus unicolor* Greater kudu - *Kudu Tragelaphus sp.* Giraffe - *Giraffa sp.* Japanese deer - *Cervus nippon*
Proboscidea	Asian elephant- *Elephas maximus*

Rodentia	Porcupine - *Hystrix sp.* Capybara - *Hydrochoerus hydrochaeris*
Lagomorpha	Rabbit - *Lepus sp.*
Diprotodontia	Wallaby - *Dorcopsis sp.* Kangaroo - *Macropodida*
Primates	Chimpanzee - *Pan sp.* Rhesus monkey - *Macaca mulatta* Gibbon - *Hylobates sp*. Silver leaf monkey -*Trachypithecus cristatus* White-handed gibbon - *Hylobates lar* Toque monkey - *Macaca sinica* Purple-faced leaf monkey - *Trachypithecus vetulus,* Capuchin monkey - *Cebus sp*. Ring-tailed lemur - *Lemur catta,* Hamadryas baboon - *Papio hamadryas*
Carnivora	African lion - *Panthera leo* Jungle cat - *Felis chaus* Fishing cat - *Prionailurus viverrinus* Otter - *Lutra sp.* Brown bear - *Ursus arctos* Sloth bear - *Ursus ursinus* Jackal - *Canis aureus* Bengal tiger - *Panthera tigris* White tiger - *Panthera tigris* Sri Lankan palm civet- *Paradoxurus sp.* Leopard - *Panthera pardus*

2.4 Coprological Examination

The samples were analyzed using the salt flotation technique, followed by quantification of eggs and larvae. Three grams of the fecal sample were placed into a 15 ml centrifuge tube, and a saturated NaCl solution was added until a meniscus formed. A coverslip was carefully placed on top and left undisturbed for approximately ten minutes. The coverslip was then gently removed, and the sample was examined under a mid-power and high-power compound light microscope to identify helminth eggs and larvae. The parasite stages were identified using the available keys (Goossens et al., 2005).

For the identification of helminth eggs and larvae, 3 g of feces was weighed and topped up 15 ml with distilled water in a centrifuge tube. The mixture was homogenized thoroughly using a narrow wooden applicator. The mixture was then centrifuged at 1500 g for 10 minutes and the supernatant was discarded from the tube. The process was repeated several times until a clear suspension was visible. The obtained pellet was thoroughly mixed and emulsified using modified saturated solution. After that, the final centrifugation was done at 1500g for 10 minutes at room temperature. For the quantification the upper meniscus was aspirated and transferred to a McMaster counting chamber (Demelash et al., 2016). According to Gunathilaka et al. in 2018 Fecal egg counts (FEPG) exceeding 500 eggs per gram (EPG) were classified as heavy infections.

2.5 Statistical Analysis

Microsoft Excel (2013) and SPSS 26 were used to calculate the prevalence of helminth infections for each animal species. To examine

potential relationships, gastrointestinal (GI) helminth infection levels were analyzed in relation to food and water sources using statistical tests. Binary logistic regression was conducted to assess the significance of food type as a potential risk factor for helminth infections.

3 RESULTS & DISCUSSION

3.1 Prevalence of Helminth Parasites

Fecal samples were analyzed from 40 animal species, belonging to 8 orders. Out of these, 16 species (40.0%) belonging to 5 orders were infected with one or more GI parasites (Table 2). 3 (7.5%) cases were mixed infections (Table 2). Lagomorphs, Proboscideans, and Perissodactyla' had no GI helminths. Of the orders that were infected, all individuals of Diprotodontia (Kangaroo and Wallaby) and Rodentia (Capybara) were infected, resulting in a 100% prevalence followed by Primates (number of species 10) with an infection rate of 20%. Artiodactyla had the lowest infection rate of 10%. Carnivores had a prevalence of 81.8%, while Omnivores had a 20.0% prevalence followed by a 26.3% prevalence in Herbivores (Table 2).

A total of four different GI helminth species were identified in mammals at the Dehiwala Zoo. Among the infected animals, 80.0% had *Strongyle* spp., followed by *Ascaris* spp. and *Bertiella* spp. (13.0% each), with *Toxocara* spp. (2.5%) being the least common type of infection. *Ascaris* spp. was the most often seen in Primates, whereas *Strongyle* spp. was the most prevalent infection among other orders in Carnivores (Figure 2, 3, 4).

Primates showed low prevalence (2/10 species infected), with only *Ascaris* spp. eggs detected in two Monkey species (100–200 EPG). Despite the low prevalence, such infestations might have arisen from hand-to-mouth contamination due to poor hygiene, consumption of soil-contaminated fruits and seeds, close social interactions, and contact between wild and captive primates. Carnivora had the highest prevalence (9/11 species infected) and parasite diversity, including *Strongyle* spp. larvae, *Toxocara* spp. eggs, and *Bertiella* spp. ova, with extreme egg counts in Fishing cats (2500 EPG). Moreover, Artiodactyla had the lowest prevalence (1/10 species infected), except for the Giraffe exhibiting the highest *Strongyle* spp. egg shedding (3000 EPG). This animal was already undergoing treatment for gastrointestinal inflammation, which may have influenced the presence of helminths. Rodentia and Diprotodontia showed universal infection (2/2 species each), dominated by *Strongyle* spp. infections with moderate to high egg/larvae counts (Figure 2). Captivity increases susceptibility to parasite infections, emphasizing the need for periodic screenings and treatment protocols for these species. In contrast, three orders Perissodactyla, Lagomorpha, and Proboscidea showed no signs of helminth infections. Similar observations were recorded at the Samsun Zoological Gardens in Turkey (Gurler *et al.*, 2010) and in previous studies at the Dehiwala Zoo (Aviruppola, Rajapakse and Rajakaruna, 2016)

indicating that certain taxonomic groups may have inherent resistance to GI parasites or benefit from effective parasite control measures.

In the current study a few animals exhibited heavy infection intensity (≥500 EPG): fishing cat, otter, Sri Lankan palm civet, leopard, giraffe, porcupine, capybara, wallaby, and kangaroo. Among the Carnivora, *Strongyle* spp. and *Toxocara* spp. were the most frequent parasites, particularly in the otter, Sri Lankan palm civet, leopard, and fishing cat. The actual prevalence of low egg burdens may have been significantly understated by the modified salt flotation technique that was employed as the main diagnostic technique. These findings correspond closely with those of Aviruppola, Rajapakse and Rajakaruna in 2016, who reported a similarly high prevalence of *Toxocara* in captive carnivores. In that study, *Toxocara* infections reached intensities of 6,300 EPG in African lions and 1,000 EPG in fishing cats, reinforcing the tendency of carnivores to develop particularly high-intensity nematode infections compared to other mammalian Orders.

Comparable results have been documented in wild and captive carnivores globally, across the majority of the animal orders analyzed in the Zoo Safari of Fasano (Fagiolini *et al.*, 2010) had the highest prevalence and EPG values of gastrointestinal *Strongyles* spp. In Planckendael, (Goossens *et al.*, 2005) fecal examinations of Arabian oryx, scimitar-horned oryx, and slender horned gazelle herds revealed the presence of *Strongyle* spp. eggs in all animals. Among the ruminants, *Nematodirus* spp. was the predominant nematode in common Eland (80.0%), while *Capillaria* spp. was the most common in Sitatunga (20.8%). Coproculture of the samples identified third-stage larvae resembling *Ostertagia* spp. and *Trichostrongyluss pp*. The maximum egg counts recorded in the Arabian oryx, scimitar-horned oryx, and slender-horned gazelle herds were 600, 750, and 1,350 EPG, respectively. Additionally, *Trichuris* spp. eggs (0–200 EPG) were detected in gazelles, highlighting parasitic patterns that differ from those observed in the current study conducted in Sri Lanka. The study conducted on captive wild animals at Nandan Van Zoo, Raipur, Chhattisgarh (Thawait, Maiti and Dixit, 2014) revealed that captive wild carnivores predominantly harbored mixed parasitic infections, with infection intensity ranging from mild to severe (200–1800 EPG), whereas bears, jackals, and hyenas were infected with *Toxocara* spp. Moderate to severe infections were particularly observed in leopards, bears, and lions, while other Carnivores exhibited mild to moderate infections. Among Herbivores, barking deer showed the highest prevalence of gastrointestinal parasites (100%), followed by blue bulls (85.7%), sambers (83.3%), chausinghas (80%), spotted deer (38%), and blackbucks (35%), with infections generally being due to *Ascaris* spp. and of mild intensity (100–300 EPG). Rhesus macaques also exhibited *Toxocara* spp. infections with mild intensity (Thawait, Maiti and Dixit, 2014).

The results of the current study consistent with previous studies conducted in the same

zoological garden in 2016 (Aviruppola, Rajapakse and Rajakaruna, 2016) reported that 44 out of 70 samples (62.9%) were positive for one or more gastrointestinal parasites. Similar findings had been documented in other zoological facilities, such as the Zoo Safari of Fasano in Italy, where intestinal parasites were detected in 61.5% of samples (Fagiolini *et al.*, 2010) and the Rangpur Recreational Garden in Bangladesh, which also reported a 61.5% prevalence (Khatun *et al.*, 2014). Despite the zoo's practice of administering mass deworming treatments to all mammals every three months (personal communication with the Veterinary Officer), persistent parasite infections were still observed in certain species. In addition, synanthropic rodents such as rats and house mice, which thrive in zoo environments, were potential carriers of parasitic infections (Rahman *et al.*, 2023).

The primary mode of transmission appeared to be ingestion of embryonated eggs from contaminated environments through fecal-oral routes However, captivity increases susceptibility to parasite infections, emphasizing the need for periodic screenings and treatment protocols for these species. Urbanization and poor sanitation further contributed to rodent infestations, increasing the likelihood of parasite transmission. Regular deworming programs, stringent hygienic measures, and regulated feeding practices that reduced exposure to infectious stages were probably the reasons for the generally low prevalence of helminth infections observed in herbivores. Carnivores, on the other hand, also received routine deworming, but it might not have been as successful due to their increased risk of reinfection from consuming raw or undercooked animal-based diets, which could have acted as a continual source of parasite transmission.

Table 2. Prevalence and distribution of GI parasites in selected mammals at Dehiwala Zoological Garden, Sri Lanka: post-deworming analysis across carnivore, herbivore, and omnivore host groups

Parasite sp.	No. of infected host species	Prevalence			
		Overall	Carnivores	Herbivores	Omnivores
Ascaris spp.	2	5.0	-	-	5.0
Bertiella spp.	2	5.0	5.0	-	-
Strongyle spp.	14	35.0	22.5	7.5	-
Toxocara spp.	1	2.5	2.5	-	-

Table 3. Parasitic Infections detected in Captive Mammals at Dehiwala Zoological Gardens

Order	No. of host sp. infected/No. of host sp checked	Host species infected with parasites	Parasitic Infection		
			Parasite spp.	EPG	LPG
Primates	2:10	Silver leaf monkey (*Trachypithecus cristatus*)	*Ascaris* spp. eggs	100	-
		Purple-faced leaf monkey (*Trachypithecus vetulus*)	*Ascaris* spp. eggs	200	-
Carnivora	9:11	African lion (*Panthera leo*)	*Bertiella* spp. ova/ *Strongyle* spp. larvae	50	150
		Jungle cat (*Felis chaus)*	*Strongyle* spp. eggs / *Strongyle* spp. larvae	400	300
		Fishing cat (*Prionailurus viverrinus)*	*Strongyle* spp. eggs/ *Toxocara* spp. eggs.	2500 1500	-
		Otter (*Lutra* sp.)	*Strongyle* spp. eggs	1000	-
		Jackal (*Canis aureus*)	*Strongyle* spp. eggs	250	-
		Bengal tiger (*Panthera tigris*)	*Strongyle* spp. eggs	200	-
		White tiger (*Panthera tigris*)	*Strongyle* spp. eggs	100	-
		Sri Lankan palm civet (*Paradoxurus* sp.)	*Strongyle* spp. eggs /*Strongyle* spp. larvae	1000	200
		Leopard (*Panthera pardus*)	*Bertiella* spp. ova / *Strongyle* spp. larvae	1000	200
Artiodactyla	1:10	Giraffe (*Giraffa* sp.)	*Strongyle* spp. eggs	3000	-
Rodentia	2:2	Porcupine (*Hystrix* sp.)	*Strongyle* spp. eggs / *Strongyle* spp. larvae	500	400
		Capybara (*Hydrochoerus hydrochaeris)*	*Strongyle* spp. eggs	1500	-
Diprotodontia	2:2	Wallaby (*Dorcopsis* sp.)	*Strongyle* spp. eggs / *Strongyle* spp. larvae	500	300
		Kangaroo (*Macropodidae*)	*Strongyle* spp. eggs / *Strongyle* spp. larvae	750	350

* EPG - Eggs Per Gram and LPG - Larvae Per Gram

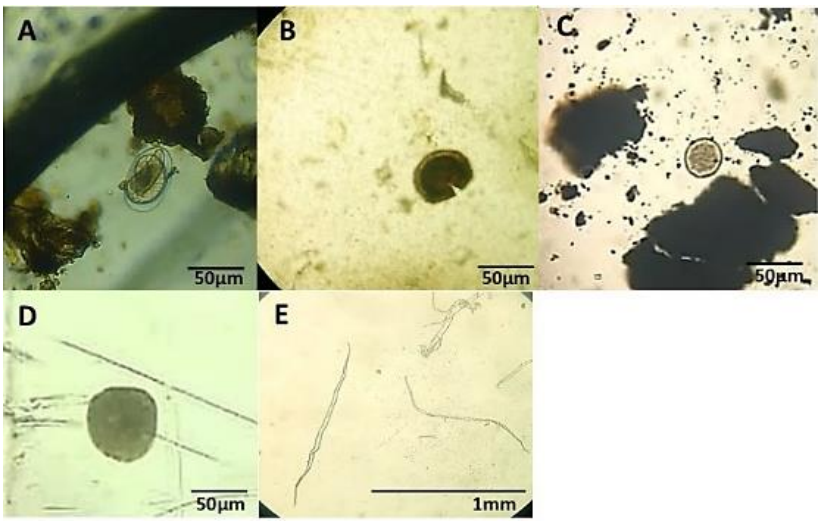

Figure 2. Helminth Eggs and Larvae Identified in Faecal Analysis of Mammals at Dehiwala Zoo. (A) *Strongyle* spp. (B) *Ascaris* spp. egg (C) Egg of *Toxocara* spp. (D) *Bertiella* spp. (E) *Strongyle* larvae (Identifcation done in compund light microcope : A,B,C,D – x400 / E – x100)

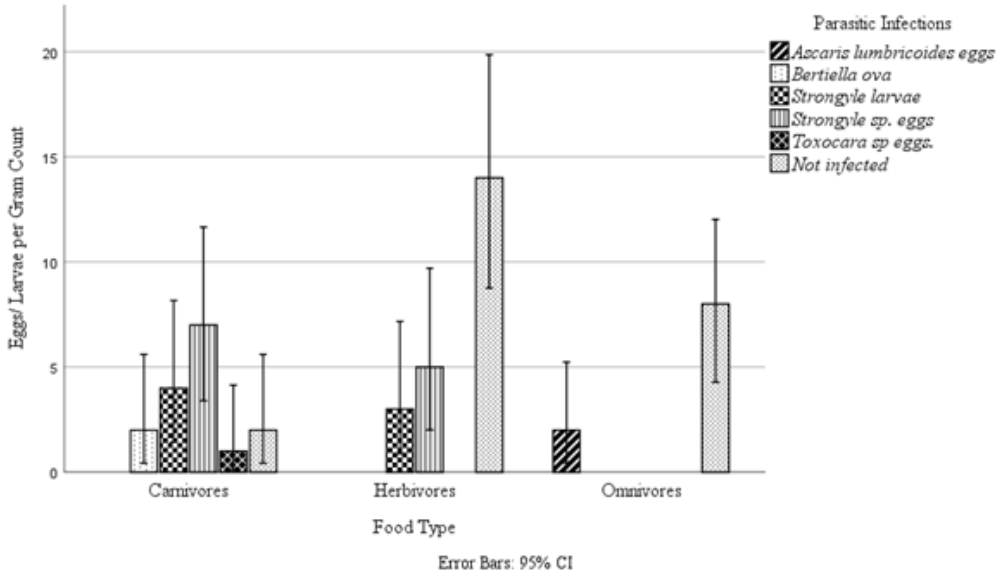

Figure 3. Count of Various Parasitic Infections by Food Type (with 95% Confidence Intervals)

3.2 Probable Sources of GI helminths

Based on their feeding habits, the animals were fed a variety of foods, including commercial pellets, plant-based diets (fruits, vegetables, leaves, and twigs), and animal-based diets (different types of meat and eggs), according to the results of a binary logistic regression analysis. Artificial ponds or water-feeding cups were used to supply water. According to the findings, helminth-positive cases were more common in animals fed with animal-based diets, indicating that this type of diet was a major cause of parasitic infection. Carnivorous species exhibited significantly higher odds of infection compared to Omnivores (OR=22.721, $p<0.01$) (Figure 3). However, the water source was not found to be a significant contributor of parasitic helminths among the captive animals (OR =4.244, $p>0.05$).

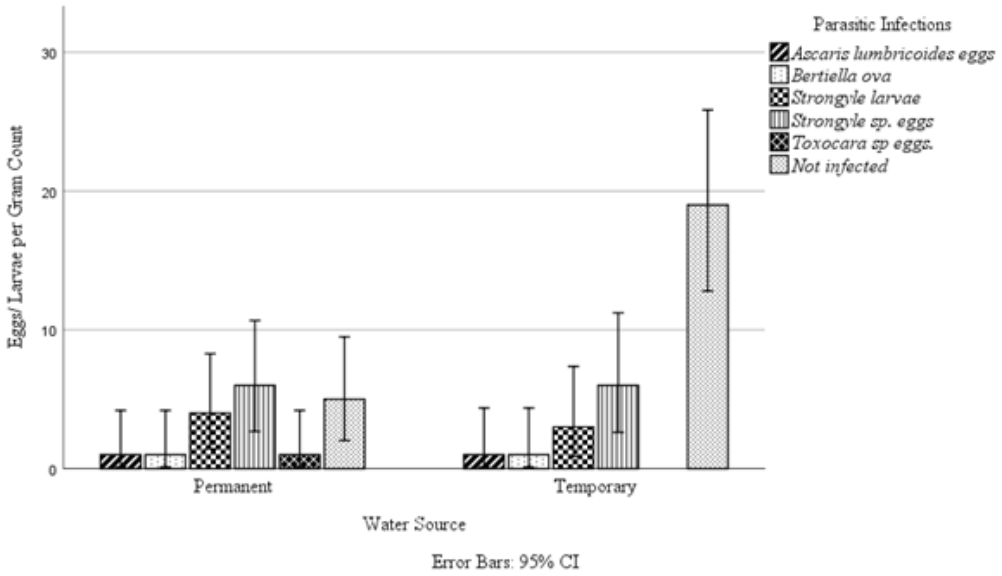

Figure 4. Count of Various Parasitic Infections by Water Source Type (with 95% Confidence Intervals)

While the zoo follows a mass deworming regimen, it is crucial to implement a more targeted deworming approach, prioritizing animals with severe infestations of pathogenic species to mitigate the risk of anthelmintic resistance. Additionally, mammals that show inherent resistance to GI parasites should be excluded from deworming schedules. A coprological analysis prior to administering antihelminthic treatments would be beneficial in identifying specific helminth burdens and optimizing deworming protocols. In this study, the lowest prevalence of gastrointestinal helminths was observed in herbivores, leading to questions about the necessity of routine deworming in these populations. Currently, treatments are often administered based on herd management protocols rather than being guided by individual diagnostics, which may not represent the most effective approach. For high-value or rare species, it is recommended that pre-treatment diagnostic testing be conducted to ensure that interventions are both necessary and appropriate.

4 CONCLUSION AND RECOMMENDATIONS

This study highlights a persistent prevalence of gastrointestinal parasites in approximately one-third of mammals at the Dehiwala Zoo, with carnivores exhibiting the highest infection burden, predominantly due to *Strongyle* spp. The findings are consistent with previous global zoo studies, indicating that animal translocation, contaminated meat, and environmental vectors (e.g., rodents and insects) significantly contribute to parasite transmission in captivity. Owing to strict hygiene practices and effective mass deworming, herbivores from the orders Perissodactyla, Lagomorpha, and Proboscidea showed no infections. However, continued infections among carnivores despite regular deworming suggest additional factors, such as diet and reinfection risk, may sustain parasite persistence.

Notably, even asymptomatic species such as Rodentia and Diprotodontia exhibited 100% infection rates, underscoring the need for routine parasitological screening. While mass deworming has reduced infections in herbivores, the results advocate transitioning toward targeted, evidence-based parasite management, focusing on high-risk species and incorporating pre-treatment fecal diagnostics to mitigate anthelmintic resistance.

Key recommendations include meat source screening, enhanced rodent control, and improved sanitation, particularly within carnivore and primate enclosures. Additional measures should involve zoonotic risk assessments and the exclusion of inherently resistant animals from routine deworming. An integrated parasite management strategy, combining improved hygiene, targeted treatments, and regular monitoring, will be essential in reducing parasite loads and preserving the health of captive mammals (Gimah, Oluwasemilore, & Iseal, 2025). Implementing such evidence-based, species-specific protocols will enhance both animal welfare and public health protection in zoological settings (Free et al., 2022).

Overall, this study focused solely on helminths; further research is warranted to investigate potential food-borne transmission pathways and other parasitic taxa to better understand infection dynamics and refine control strategies.

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