PREVALENCE AND CHEMOTHERAPY OF HELMINTH PARASITES IN CAPTIVE CERVID AT VARIOUS CAPTIVE WILDLIFE FACILITIES OF PAKISTAN

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ABSTRACT: Gastrointestinal helminths (GI helminths) pose a significant threat to deer, impacting their health, performance, and productivity. This study aimed to assess the prevalence of GI helminths in deer within the Pakistan region and to evaluate the therapeutic efficacy of albendazole and ivermectin against GI helminths. A total of 100 fecal samples were collected from various wildlife parks in Punjab and Islamabad, Pakistan. Helminth ova and egg counts were determined using direct smear, sedimentation, flotation, and McMaster techniques. The overall prevalence of GI helminths was 38%, with cestodes, nematodes, trematodes, and mixed infections observed. For the chemotherapeutic trials, infected deer were divided into two treatment groups, A and B, with 10 deer in each group. Group A received albendazole at 7.5 mg/kg body weight, and Group B received ivermectin at 0.2 mg/kg body weight, both administered orally. Fecal samples were collected on days 0 (pre-treatment), 7, 14, and 21 (post-treatment). Ivermectin proved to be more effective than albendazole, resulting in a significantly greater reduction in helminth egg counts ($P<0.05$).

Keywords: Helminth, Cervid, Prevalence, Chemotherapy, Albendazole, Ivermectin.

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INTRODUCTION

Helminths, a group of parasitic worms, and gastrointestinal (GIT) parasites are widespread and pose significant health threats to wild animals. These parasites, which include nematodes, cestodes, and trematodes, inhabit the digestive systems of their hosts and can cause severe health issues. The helminth parasites find refuge in the gastrointestinal tract of animals, leading to both subclinical and clinical parasitism (Abbas et al., 2016). In wild animals, GIT parasites often go unnoticed due to the natural resistance developed over time (Tanveer et al., 2022). However, this resistance is frequently compromised when animals are held in captivity, leading to higher rates of parasitic infestations and associated diseases (Roeber, Jex, Gasser, & vectors, 2013).

Indeed, deer, commonly referred to as "harin" in certain regions, are remarkable creatures belonging to the family Cervidae and the order Artiodactyla. These animals are notable for their widespread presence across diverse ecosystems globally, with a significant concentration of larger species in southern Southeast Asia, including countries like India and Nepal (Kanungo et al., 2011). Fallow deer, often classified as farm animals, are primarily raised for their meat and antlers on breeding farms. They are also bred in expansive enclosed fields or allowed to roam freely; serving as game animals during designated hunting seasons (Kowal et al., 2012).

As integral components of ecosystems, deer are wild ruminants that play a crucial role in maintaining ecological balance (Kanungo et al., 2010). However, no animal in nature is entirely free from parasites (Dey et al., 2014). While animals in the wild possess natural resistance to parasitic infections, this resistance often diminishes in captivity, leading to increased parasitic infestations (Virendra et al., 2014). When wild animals are transitioned to captivity, despite quarantine measures, the new conditions often prove unfavorable for the animals but favorable for parasites. The prevalence of parasites in zoo-housed animals can vary depending on husbandry practices, disease prophylaxis, and treatments administered (Dey et al., 2014).

The presence of parasites and infectious diseases in deer is particularly critical, as it can lead to mortality, population decline, and even extinction (Mir et al., 2016). Helminths, among other parasites, can severely affect

deer, especially young ones, resulting in reduced body condition scores, decreased weight gain, and reproductive disorders. Additionally, parasitic infestations can compromise the quality of animal products such as meat, skin, and antlers (Labony et al., 2014). Chemotherapy is the primary and only treatment for helminthiasis, though resistance to anthelmintic drugs like benzimidazole derivatives has been noted. Reduced albendazole effectiveness against hookworms may not indicate true resistance, as a follow-up study linked its efficacy to meal timing and nutrition (Coffeng, Stolk, & de Vlas, 2024; Pattanayak et al., 2023).

The purpose of this study is to enhance the available data on gastrointestinal parasites in deer in Pakistan. The research has two main objectives: firstly, to determine the prevalence of gastrointestinal parasites in deer in Punjab, Pakistan, and secondly, to carry out chemotherapeutic experiments using two allopathic drugs in deer indicating their efficacy. This study offers valuable insights into the occurrence and spread of gastrointestinal parasites in deer populations, contributing to the advancement of effective treatment strategies and control methods to improve the health and well-being of deer in the region.

METHODOLOGY

Area and sampling animals: Sample collection for this study was conducted across various regions of Punjab and Islamabad, Pakistan, including Safari Zoo Lahore, Wildlife Park Jallo Lahore, Wildlife Breeding Center, Faisalabad, private captive deer facilities in and around Lahore, and CDA Zoo, Islamabad. A total of 100 deer were examined to detect various endoparasites during the study.

Collection of fecal samples: Approximately 5 grams of fecal samples were collected either freshly passed or directly from the rectum of each animal. Disposable gloves were used for this purpose, and with the aid of a suitable lubricant, a finger was inserted into the rectum after properly restraining the animal to collect fecal samples. In cases of freshly passed feces, samples were obtained from the center to avoid soil contamination. The samples were then placed in self-sealing polythene bags and transferred to the laboratory in an ice pack cooler for further examination at the Department of Veterinary Medicine, UVAS laboratory.

Examination of fecal samples: The initial screening for detecting the presence of helminths was observed by utilizing the direct smear method, following the manual (Hendrix and Robinson, 2006). The confirmation of fecal samples having ova was further done by flotation (Zajac and Conboy, 2006) and sedimentation techniques (Taylor et al., 2007). The parasites genera were identified based on morphological evidence. The egg count was performed by McMaster technique (Taylor et al., 2007) on day zero pre-medication and days 7 and 14 post-medication using three grams of feces per sample.

Therapeutical trails: A total of 20 positive animals were randomly selected from Punjab and subdivided into two groups. The cervids of Group A were treated with Albendazole at a dosage of 7.5 mg/kg orally once, and Group B with Ivermectin at a dosage of 0.2 mg/kg orally once. Fecal samples from both treatment groups were collected on day 0 (pre-medication) and subsequently on days 7, 14, and 21 (post-medication) for examination of endoparasites.

RESULTS

Prevalence: Out of 100 samples, 38 were found positive for various gastrointestinal helminths in deer, resulting in a positive rate of 38%. Among the positive animals, 12 (31.57%) were positive for Cestodes, 6 (15.79%) for Nematodes, 12 (31.57%) for Trematodes and the remaining 8 (21.05%) were having mixed infection of more than one helminth species. **Table 1** indicates the total positive animals and their percentages for gastrointestinal helminth parasites at different captive sites studied.

Table 1: Positive percentage of gastrointestinal helminth parasites in cervid at different captive sites.

Captive sites	No of positive animals (n=38)	Positive percentage (%)
Safari Zoo, Lahore	18	47.36
Wildlife Park Jallo, Lahore	7	18.42
Private facilities around Lahore	6	15.78
Wildlife Breeding Centre, Faisalabad	5	13.15
CDA Zoo, Islamabad	2	5.26

Therapeutic trials

Cestodes: There was a significant difference observed in the EPG of Cestodes in groups A and B when the post-treatment count was compared with the pre-treatment count. In group A, a decrease in EPG, i.e. 42.59%, 71.3%, and 88% was observed on days 7, 14, and 21 respectively. While in group B, 42.59%, 73.15%, and

89% of the decrease in EPG was observed on days 7, 14, and 21 respectively, (**Tables 2)**.

Nematodes: A significant difference was again found when the decrease in EPG of Nematodes in group A was compared with group B. i.e. 33.33%, 60%, and 83% reduction of EPG at days 7, 14, and 21 respectively in group A and 52%, 76 %, and 91% at days 7, 14, and 21 respectively in group B **(Table 3)**.

Trematodes: There was also a significant difference when the decrease in EPG of Trematodes in group A was compared to group B. In group A, there was a marked decrease in EPG on days 7, 14, and 21 demonstrating 40.18%, 68.22%, and 89.72% respectively while in group B, the EPG decrease was 42.85%, 64.28%, and 85.71% on days 7, 14 and 21 respectively **(Table 4)**.

Table 2: Fecal egg count (EPG) of Cestodes in cervid at days 0, 7, 14, and 21 and their percent reduction by therapeutic agents.

Animal Group	Therapeutic agents	EPG of Cestodes: Mean ± SD (% Reduction in EPG)			
		Day 0	Day 7	Day 14	Day 21
A	Albendazole	720±413.12	413±204.4 (42.59)	207±110.05 (71.3)	87±48.30 (88)
B	Ivermectin	720±379.5	413±154.91 (42.59)	193±87.56 (73.15)	80±63.24 (89)

Table 3: Fecal egg count (EPG) of Nematodes in cervid at day 0, 7, 14, and 21 and their percent reduction by therapeutic agents.

Animal Group	Therapeutic agents	EPG of Nematodes: Mean ± SD (% Reduction in EPG)			
		Day 0	Day 7	Day 14	Day 21
A	Albendazole	740±463	493±313 (33)	293±217.05 (60)	127±128.7 (83)
B	Ivermectin	746±391.01	360±158 (52)	180±82.32 (76)	66±66.7 (91)

Table 4: Fecal egg count (EPG) of Trematodes in cervid at days 0, 7, 14, and 21 and their percent reduction by therapeutic agents.

Animal Group	Therapeutic agents	EPG of Nematodes: Mean ± SD (% Reduction in EPG)			
		Day 0	Day 7	Day 14	Day 21
A	Albendazole	1070±262.7	640±150.55 (40.2)	340±135 (68.22)	960±73.78 (89.72)
B	Ivermectin	980±349	560±183.78 (42.85)	350±126.92 (64.28)	840±84.32 (85.71)

DISCUSSION

Deer holds significant importance for humans, serving various purposes ranging from being captivating zoo attractions to pets. However, deer are severely impacted by gastrointestinal helminth parasites and other ectoparasites. These internal parasites lead to detrimental effects such as reduced body weight, poor health, anorexia, reproductive failure, and even death, particularly among young deer. Therefore, the present study aimed to assess the prevalence of gastrointestinal parasites in deer and evaluate the effectiveness of two anthelminthic drugs, ivermectin and albendazole, through chemotherapeutic trials.

This study provided a 38% prevalence rate which is in harmony with the results of Labony *et al.*, (2014) who reported similar prevalence rates of gastrointestinal parasites in deer in Bangladesh, with nematodes, trematodes, protozoa, and mixed infections recorded at 29.13%, 25.19%, 5.31%, and 9.45%, respectively. Similarly, Hayat *et al.,* (1998) documented a prevalence of around 40% for different endoparasites in deer.

Studies by Qurashi *et al.,* (1990) and Gupta *et al.,* (2006) also support these findings, with Qurashi et al., reporting an efficacy of albendazole at 82-84%, and Gupta et al., noting a 25.71% prevalence of gastrointestinal parasites in various wildlife herbivores, including deer. Burlinski *et al.,* (2011) found a prevalence rate of 42.09% for gastrointestinal parasites in cervids in Northern Poland.

Additionally, Virendra *et al.,* (2014) observed similar prevalence rates in captive animals at the Nandan Van Zoo in Raipur, India, with parasites present in 60% of primates and 45.6% of herbivores, including various deer species. However, Smith *et al.,* (1964) reported differing prevalence rates across regions, with 41% prevalence in Ontario but 56.4% and 75% in Michigan and Pennsylvania, respectively.

Meshram *et al.,* (2008) found a notably higher prevalence rate of 89.05% in Indian deer, which could be attributed to regional differences and variations in animal management practices during captivity. These discrepancies underscore the importance of localized studies to accurately assess parasite prevalence and develop effective management strategies.

These results of chemo-threptic trials are consistent with previous research. Pilarczyk *et al.,* (2015) demonstrated the efficacy of ivermectin against nematodes in farmed fallow deer. They found the presence of nematodes in deer and controlled them by 1% ivermectin deworming twice in December and March. The efficacy of ivermectin these two months was 94.44% and 95%, respectively.

Foreyt and Drawe (1985), stated that the efficacy of albendazole was 89% against trematodes when provided at 26mg/kg. Qurashi *et al.,* (1990)) studied the effects of albendazole in thirty-six white-tailed deer separated into four groups of eight, nine, nine, and ten deer. The medicated feed was shown to be 84% effective in group one, 84% in group two, and 82% in group three, whilst group four received no albendazole treatment.

Gupta *et al.,* (2006) showed that anthelmintics can reduce the egg count of gastrointestinal parasites by 100%. Mohammad *et al.,* (2007) observed the efficacy of ivermectin in deer species. Kanungo *et al.,* (2011) found albendazole efficacy at 96.65% against gastrointestinal nematodes. Nordkvist *et al.,* (1983) demonstrated ivermectin as the most efficient anthelminthic with 100% efficacy in deer.

Conclusions: The overall prevalence of helminth parasites in captive cervid was found to be 38%. Amongst the two therapeutic drugs, Ivermectin was found more effective as compared to albendazole in reducing parasitic burden in deer. However, albendazole still significantly reduced the egg count.

Recommendations: Implement comprehensive epidemiological assessment and targeted intervention strategies to identify, mitigate, and control driving factors of helminth parasite transmission in captive cervid populations, ensuring optimal animal health and welfare

- More therapeutic agents may be tested for alternative treatment options

Conflict of Interest: There is no conflict of interest among the authors.

REFERENCES

Abbas, G., M. Z. U. Rehman, A. Ali, M. Fiaz, A, Mahfooz. 2016. Effect of Use of Different Anthelmintics (Piperazine Citrate and Ivermectine) on Blood Profile of Infested Poultry (Commercial and Rural Layers). Advances in Zoology and Botany 4(1): 1-5.

Burlinski, P., Janiszewski, P., Kroll, A., and Gonkowski, S., 2011. Parasitofauna in the gastrointestinal tract of the cervids (Cervidae) in Northern Poland. Acta Veterinaria (Beograd), Vol. 61, No. 2-3, 269-282.

Coffeng, L. E., Stolk, W. A., & de Vlas, S. J. J. N. C. (2024). Predicting the risk and speed of drug resistance emerging in soil-transmitted helminths during preventive chemotherapy. 15(1), 1099.

Dey, A. R., Rahman, S. M., Kundu, U.K., Begum, N., 2014. Investigation of gastrointestinal parasites of herbivores at Dhaka National Zoological Garden of Bangladesh. J. Bangladesh Agril. Univ. 12(1): 79–85, 2014 ISSN 1810-3030

Foreyt, W.J., Drawe, L.D., 1985. Efficacy of clorsulon and albendazole against Fascioloides magna in naturally infected white-tailed deer. *J. Am. Vet. Med. Assoc*., 187: 1187-8.

Gupta, P.M., Singh, P., Singla, L.D., Sharma, S., Sandhu, B.S., Sharma, D.R., 2006. Parasitic infection in wild herbivores in the Mahendra choudhury zoological park, chhatbir, Punjab. *Zoos' Print Jounal.*, 21: 2459-2461.

Hayat, C.S., Maqbool, A., Hayat, B., Badar, N., Lateef, M., 1998. Prevalence of various endoparasitesin deer. *Pakistan J. Zool*., 30: 269-270.

Hendrix, M.C., Robinson, E.D., 2006. Diagnostic parasitology for veterinary technicians 3rd ed. Mosby Elsevier 11830 Westline Industrial Drive St. louis, Missouri 63146.

Kanungo, S., Das, A., Gupta, D.A., Shakif-ul-Azam, 2010. Prevalence of gastro-intestinal helminthiasis in captive deer of Bangladesh. Wayamba journal of animal science, issn: 2012-578x; 42- 45.

Kanungo, S., Das, A., Gupta, D.M., Fazlul-huque, A.K.M., 2011. Hematological alternation and therapeutic efficacy of selected anthelminthics in gastrointestinal nematode infected spotted deer (Cervus Axis). Wayamba Journal of animal sciences. ISSN: 2012-578X: 107-109.

Kowal, J., Nosal, P., Bonczar, Z., Wajdzik, M., 2012. Parasites of captive fallow deer (Dama

dama L.) from southern Poland with special emphasis on Ashworthius sidemi. Annals of Parasitology 2012, 58(1), 23–26

Labony, S.S., Barmon, B.C., Begum, N., , Kundu, U.K., Dev, A.R., Dev, T.R., 2014. Study of gastrointestinal parasites of deer at char kukri mukri in bhola district. *Bangl. J. Vet. Med*., 12: 27-33.

Meshram, M.D., Shirale, Y.S., Khillare, P.K., 2008. Incidence of Helminthic infection in Axis Deer. *Veterinary World.*, 1:10.

Mir, A.Q.[1], Dua, K.[1],. Singla L.D.[2], Sharma, S.,[1] Singh, M.P.[3], 2016. Prevalence of parasitic infection in captive wild animals in Bir Moti Bagh mini zoo (Deer Park), Patiala, Punjab. *Veterinary World, EISSN:2231-0916*. 9: 540-543.

Mohammad, B.O., Omer, S.A., Sandouka, M.A., 2007. The efficacy of Ivermectin and Levamisole against natural Nematodirus spathiger infection in the Arabian sand gazelle (Gazella subgutturosa marica) and the Arabian mountain gazelle (Gazella gazella) in Saudi Arabia. *Veterinary Parasitology*, 150: 170–173.

Nordkvist, M., Rehbinder, C., Christensson, D., 1983. A comparative study on the efficacy of four anthelmintics on some important reindeer parasites. *Rangifer*, 3: l9-38.

Pattanayak, P., Panigrahi, D., Kumari, S., Yadav, H. N., Ashby, C. R., Kerber, S., . . . Mishra, G. P. J. J. o. M. S. (2023). Benzimidazoles in helminthiasis chemotherapy: Developments and challenges. 136716.

Pilarczyk, B., Tomza-Marciniak, A., Udała, J., Kuba, J., 2015. The prevalence and control of gastrointestinal nematodes in farmed fallow deer (*Dama dama* L.). Vet. Arhiv., 85, 415-423.

Qurashi, T., Davis, D.S., Drawe, D.L., 1990. Used of albendazole in feed to control Fascioloides magna infection in captive white-tailed deer (Odocoileus virginianus). *Journal of Wildlife Disease*, 26: 231-235.

Roeber, F., Jex, A. R., Gasser, R. B. J. P., & vectors. (2013). Impact of gastrointestinal parasitic nematodes of sheep, and the role of advanced molecular tools for exploring epidemiology and drug resistance-an Australian perspective. 6, 1-13.

Smith, H.J., Archibald, R.Mcg., Cornert, A.H., 1964.Elaphostrongylosis in Maritime Moose And Deer. *Canadian Veterinary Journal*, 5: 287-295.

Tanveer AJ, Abbas G, Iqbal A, Anwar M, Khan AA, Tauqeer R, Fayyaz A, Asgher A and Tauqeer S, 2017. Pharmacological management of gastric myiasis in a lion. J Toxicol Pharmaceut Sci, 5(2), 45-48.

Taylor, M.A., Coop, R.L., Wall, R.L., 2007. Veterinary Parasitology 3rd ed. Blackwell Publishing.

Virendra, K.T., Maiti, S.K., Aditi, A.D., 2014. Prevalence of gastro-intestinal parasites in captive wild animals of Nandan Van Zoo, Raipur, Chhattisgarh. *Veterinary World, EISSN: 2231-0916*. 7: 448-451.

Zajac, M.A., Gary, A.C., 2006. Veterinary Clinical Parasitology. 7th ed. Blackwell Parasitology 2121 State Avenue, Ames IOWA 50014, USA.