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Transmission of Gastrointestinal Parasites in Between Deer and Livestock Species at Buffer Zone Located Within the Eastern Part of Chitwan National Park, Nepal

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ABSTRACT

Deer are the hoofed ruminants of the order Artiodactyla and suborder Ruminantia in which infectious disease and parasites are of major concern in their conservation. This specific research helps us to determine the transmission of gastrointestinal parasites between deer and livestock in the buffer zone. The study was conducted in the eastern part of Chitwan National Park from June 2020 to July 2020. Fecal examination for the parasitic load was carried out using Floatation and Sedimentation techniques. 96.49% of the total fecal samples tested for parasitic eggs were found to be positive for the prevalence of gastro-intestinal parasite whereas parasitic prevalence in livestock of Buffer Zone i.e. Sauraha and Bachhauli area was calculated to be 87.30% based on the examination conducted within that same period and same area by the veterinary hospital. Pramphistomum was the most prevalent one in both deer (72.73%) and livestock (52.44%). The finding of this research revealed the higher chances of the exchange of parasites between the deer and livestock. A more advanced study must be done in this sector and concerned authorities should develop and implement effective plans to prevent the cross-transmission of parasites between deer and livestock and other wildlife.

Keywords: *ruminants;parasite, egg, prevalence, Gastrointestinal Parasites Buffer Zone*

INTRODUCTION

Deer are the hoofed ruminants of the order Artiodactyla which are recognized by symmetry in the feet and members of the Ruminantia suborder. They belong to the family Cervidae which includes about 44 species [1]. Among many species, four species of deer; Spotted Deer (*Axis axis)*, Hog Deer (*Axis porcinus)*, Sambar Deer (*Rusa unicolor / Cervus unicolor)*, and Barking Deer (*Muntiacus muntjak*) are distributed in the Chitwan National Park.

Livestock in many buffer zone areas is dependent on the fringe of the national park for grazing. Most common grazing lands in the buffer zone are adjacent to the park because of waterholes, rivers, and wallowing ponds [2]. Elephants, rhinos, deer, and livestock (cattle, buffalo, sheep, goat, equines, and swine) are likely to share parasite species since they graze, drink and defecate in the same geographical area and have the same anatomical features. Once parasitic transmission is established in wild animals, the wild envi-

ronment will be polluted with parasites [3]. This can have a deleterious effect in the long term and control measures will be more problematic. Although wild animals are resistant to parasites, with the increase in parasite transmission and shortage of food, parasite load may increase with the loss of health aspects. Eventually, it decreases its threshold resistance. Also, the parasite exchange among the different species may lead to species hybridization and higher economic loss in the livestock sector too [4].

The population of these species is declining due to different reasons including habitat loss and degradation, poaching and illegal trades, diseases, human-wildlife conflicts, etc. Infectious diseases and parasites are the major concern in the conservation of these species as they can lead to mortality, dramatic population declines, and even contribute to local extinction events [5]. This study attempts to investigate the prevalence of gastrointestinal parasites in wild deer having regular interaction with the livestock in buffer zones of Chitwan National park.

Common grazing land, water sources, and habitat sharing between livestock and wildlife lead to parasite sharing as well as disease transmission among them. Increased sharing of natural habitat resulting from increased demand for agriculture, grazing, water, and a diverse array of anthropogenic activities leads to increased interaction between livestock and wildlife [6]. Such interactions bring clash for food, provide opportunities for pathogen sharing, and may result in species hybridization too.

MATERIAL AND METHOD

Site of study

The study area was the south-eastern part of Chitwan National Park i.e. Sauraha Buffer Zone. Chitwan National Park is the first National Park located at 27.5341° N, 84.4525° E at the terai (Siwalik) belt of mid-Nepal. The park is present in an area of 932 sq. km including the part of Parsa, Makawanpur, Nawalpur, and Chitwan districts, and also encloses Rapti-Valley, Churia hill, Ox-bow Lake, rivers like Narayani, Rapti, Reu, and Sal dominated forest, grassland along with the floodplain.

Sample Collection and Processing

Pelleted fecal samples were collected between June and July 2020 from resting sites (buffer zone) of deer early in the morning. After visual assessment of consistency and appearance, around 20 grams of fresh fecal samples covered with moist mucous were taken. The collection was done in a zip lock bag and preserved in 10 % formaldehyde for further laboratory examinations. After this, the sample was taken to the laboratory of the National Trust for Nature Conservation, Biodiversity Conservation Center (NTNC, BCC) Sauraha, Chitwan. Then, a Coprological examination for the parasitic load was carried out by using Floatation and Sedimentation techniques.

Fig 1: Fecal sample of deer present in wild condition

Fecal examination

Sedimentation Technique

To detect trematode eggs, a sedimentation method was performed. Trematode eggs are often heavier as compared to other helminths and sedimentation is the best technique recommended for trematodes.
For this, a 3-gram fecal sample was weighed using the weighing machine. The sample was minced using a mortar and pestle. The minced sample was mixed with about 200 ml water and then passed through a tea strainer to remove the large debris in the fecal sample. The liquid solution passed through the strainer was collected in a beaker and sedimented for 10 minutes. The supernatant solution of the beaker was removed carefully without disturbing the sediment. Again the same volume of water was poured into the beaker containing the sample, and left for sedimentation, and the supernatant solution was removed after 10 minutes. The sediment was ready for observation so a drop of sediment was taken with a dropper on a clean glass slide. After spreading it over the slide, the fecal sample smear was observed under the compound microscope at 10x and 40x.

Floatation Technique

To detect eggs of nematodes, the floatation technique was used using the McMaster egg counting chamber [7]. Nematode eggs are lighter though they don't float in normal water and need to add a floatation solution. For this, First of all, a 3-gram fecal sample was weighed using the weighing machine. Then the sample was minced using a mortar and pestle. 42 ml water was poured into the sample and the whole mixture was passed through a tea strainer into the next vessel and debris was discarded. Then the sample was mixed thoroughly and poured into a centrifuge tube to the top and centrifuged at 3000 rpm for 3 minutes. The supernatant was then poured off then an equal volume of floatation solution was added into the tube after 2-3 minutes the topmost layer of solution was taken to fill the chamber of Mc-Master. The chamber was examined using a compound microscope at 10x and 40x. In the case of livestock, retrospective data was taken from the Veterinary Hospital of Buffer Zone Area Livestock Consumers Committee, Bachhauli, Chitwan, a major hospital for livestock, from the same area within the same time frame

Data analysis

The collected data was stored in MS-Excel and was analyzed both qualitatively and quantitatively using SPSS version 20. Thus obtained results were either presented in tabular form or using various graphical representation methods.

Results and Discussion

Out of the total 57 fecal samples tested for parasitic eggs, the overall prevalence of parasitic eggs was 96.49% (55 samples positive) in deer. Two species of trematodes (Paramphistomum spp. and *Fasciola* spp.), one species of cestodes (*Moniezia* spp.), and three species of nematodes (Strongyle, *Strongyloides* spp., *Trichuris* spp.) were observed in the feces of different species of deer.

Similarly, the parasitic prevalence in livestock of the buffer zone i.e. Sauraha and Bachhauli area was calculated to be 87.30% (250 samples positive) out of 286 fecal samples tested by the Veterinary Hospital of Buffer Zone Area Livestock Consumers Committee. Two species of trematodes (*Paramphistomum* spp. and *Fasciola* spp.), one species of cestodes(*Moniezia* spp.), and four species of nematodes (Strongyle, *Strongyloides* spp., *Trichuris* spp. and *Ascaris* spp.) were observed in feces of different livestock as per the data of.

Table1: Combination of multiple gastrointestinal parasites observed in feces of deer

Name of the parasites	The number of fecal samples tested positive for	Prevalence (%)
Paramphistomum only	17	30.91
Fasciola only	3	5.45
Strongyle only	4	7.27
Paramphistomum, Strongyle	10	18.18
Paramphistomum, Fasciola	6	10.91
Paramphistomum, Strongyle, Fasciola	2	3.64
Paramphistomum, Strongyloides	5	9.09
Strongyle, Strongyloides	3	5.45
Strongyle, Moniezia	3	5.45
Strongyle, Trichuris	2	3.64
Total	55	100

Table 2: Species wise prevalence (%) of gastrointestinal parasites in deer

Name of the parasites	The number of fecal samples tested positive for (Out of 55)	Prevalence (%)
Paramphistomum	40	72.73
Fasciola	11	20
Strongyle	24	43.63
Strongyloides	8	14.54
Moniezia	3	5.45
Trichuris	2	3.63

Table 3: Species wise prevalence (%) of gastrointestinal parasites in livestock

Name of the parasites	The number of fecal samples tested positive for (Out of 250)	Prevalence (%)
Paramphistomum	150	52.44
Fasciola	52	18.18
Strongyle	121	42.30
Strongyloides	41	14.34
Moniezia	5	1.75
Trichuris	18	6.29
Ascaris	33	11.54

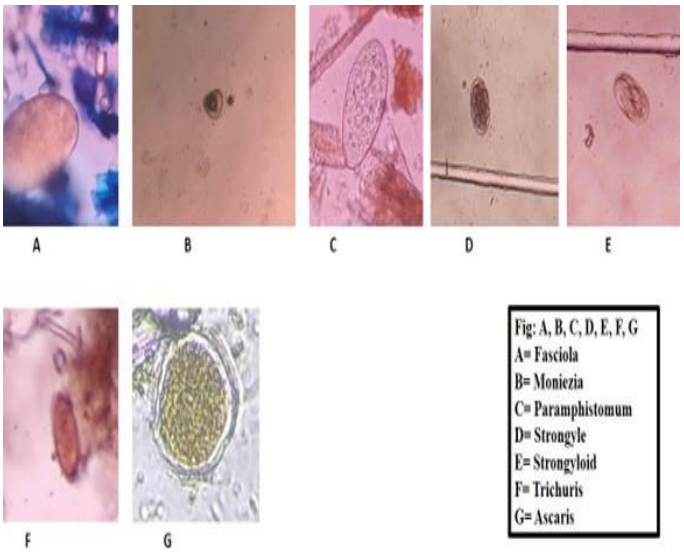

Fig 2: The figure above shows multiple species of gastro-intestinal parasites found during fecal examination

Pramphistomum(72.73%) was the most prevalent one followed by Strongyle (43.63%), *Fasciola*(20%), *Strongyloides*(14.54%), *Moniezia*(5.45%) and *Trichuris*(3.63%) in deer Similarly, in the case of livestock, *Paramphistomum*(52.44%) was also found to be the most prevalent parasite as that of deer followed by *Strongyle*(42.30%), *Fasciola*(18.18%), *Strongyloides*(14.34%), *Ascaris*(11.54%), *Trichuris*(6.29%), and *Moniezia*(1.75%). As these different deer species and livestock share a common ecosystem for grazing, defecating, and other activities, there may be a higher chance of mutual transmission of parasites between them.

A survey of gastrointestinal parasites in Axis deer of Barandhabhar Corridor Forest, Chitwan depicted that about 88% of the samples tested were found to be positive for GI parasites like *Entamoeba* spp., *Entamoeba coli*, *Balantidium coli*, *Cryptosporidium*, *Eimeria* spp., *Fasciola*spp., *Paramphistomum*, *Strongyle*, and *Strongyloides*[8]. Our result was not in line with the findings of [9] in musk deer of Langtang National Park Nepal which revealed that *Ascaris* (88.89%) was the predominant one followed by *Eimeria* sp. (77.78%), *Trichuris* sp. (66.67%), *Strongyloides* sp. (55.56%), *Moniezia* sp. (44.44%), *Strongyle* (44.44%) and *Paramphistomum* sp. (44.44%). This difference in outcome between Langtang and Chitwan National Park is still to be studied.

Strongyle spp., *Trichostrongyle* spp., *Fasciola* spp., *Moniezia* spp., and *Paramphistomum* spp. were reported in swamp deer and livestock from JhilmilJheel Conservation Reserve (JJCR) and Uttarakhand and Kishanpur Wildlife Sanctuary (KWLS), India[10]. *Fasciola*, *Paramphistomum*, *Strongyle*, *Strongyloides*, *Oesophagostomum*, and *Trichuris* were also observed and reported in Hog Deer and *Fasciola*, *Paramphistomum*, *Ascaris*, *Strongyle*, *Oesophagostomum*, and *Coccidia* in swamp deer of Kaziranga National park Assam[11]. The prevalence of nematode (*Strongyle* spp.), cestode (*Moniezia* spp.), and trematode (*Amphistome* spp.) was also detected in different deer species (Spotted deer, Sambar deer Hog deer, and Blackbuck) of Thrissur zoo of India[12].

Interspecies transmission of parasites takes place due to the interaction of animals in a common environment[13]. Around 90 % of carnivores, 77 % of livestock, and 60% of human pathogens are multi-host in nature and among the 77% of livestock pathogens, most of them have the capacity of affecting wild ungulates[14]. Conservation exertion in wildlife and at the wildlife interface has been disturbed by diseases and parasitic infections due to the intensification of ranges of host species[15]. Most of these parasites can attack an unusually huge number of host species as they are opportunistic in nature[6]. Parasites alone hardly play a direct role in host extinction but are responsible for alteration in the host population in combination with other factors like habitat deprivation and climate change[16]. The role of parasites in affecting the host population is concerned with the impacts on survival, reproduction, and trophic equilibrium[17].

Gastrointestinal parasitism is a major problem for livestock which lowers production and brings huge economic loss. In this study, Paramphistomum infestation was found to be higher in both deer and livestock. Generally, Paramphistomum remains in the rumen and reticulum of animals and induces the problem of intestinal wall erosions, hemorrhage, and necrosis of ruminal papillae[18]. Heavy infestation of nematodes causes anemia, iron deficiency, and abdominal disorders which may have a significant impact on livestock as well as wild animals[19]. Ascaris spp. remain up to 15 years in soil and cause diarrhea, malnutrition, and obstruction of the intestine(Hagel &Giusti, 2010). Prevalence of Strongyle causes anorexia, inappetence, watery diarrhea, and weight loss in ruminants. Similarly, Strongyloides cause anorexia, weight loss diarrhea, and anemia in deer as well as livestock. Heavy infection of Moniezia in lambs, kids, and calves may show diarrhea, unthriftiness, and intestinal obstruction[21].

CONCLUSION AND RECOMMENDATION

This study showed that different deer species in the Eastern part of Chitwan National Park, Nepal had a high prevalence of gastrointestinal parasites including trematodes, nematodes, and cestodes. As well as similar kinds of parasites were prevalent in the gastrointestinal tract of the livestock of the buffer zone which shares the common grazing land and ecosystem with the wildlife. The finding of this research revealed a higher chance of the exchange of parasites between the deer and livestock. Theremay also be the chances of cross-transmission of parasites between livestock and other wild herbivores like One-horned Rhinoceros and Elephants. Further study should be done in this sector and the concerned agency should develop a proper management program to limit the transmission of parasites between deer and livestock and formulate new conservation policies too.

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Conflict of interest

The authors don't have any conflict of interest to disclose.

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