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Epidemiological investigation of parasitic infestation in dogs: A clinical study

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Abstract
Dogs harbour zoonotic parasites that cause serious infections in humans, such as visceral larva migrans, ocular larva migrans, cystic *echinococcosis*, and alveolar *echinococcosis*. Studies on dog gastrointestinal parasites in different geographical locations are required to increase knowledge of the risk of canine zoonoses in human population. The presence of parasites was examined in 30 faecal samples collected from dogs that were registered in small animal medicine section of Veterinary clinical complex, LUVAS, Hisar , from July' 2021 to August' 2021. Oval, thin-shelled eggs with 8-16 embryonated cells of *Ancylostomum caninum* was the only garstrointestinal parasite found in 7 (23.3%) out of 30 faecal samples. Male, 0-4month old puppy and mixed dog breed were found to be predominantly affected. Treatment was started with tablet containing Praziquantel 50 mg, Pyrantel pamoate 144 mg and Fenbendazole 500 mg and ivermectin subcutaneously @ 200µg/kg in dogs with vomition. Only 3.33% of pet owners found to be aware of the risks for human health from canine intestinal parasites.

Keywords: Parasites, dewormer, fecal examination, haematological examination.

Introduction
The worldwide dog population has been estimated to be more than 500 million (Kantere *et al.*, 2014) [6] and number of households with pet dogs and cats in India accounted for approximately 17million and 1.5 million respectively (Statista, 2018). Intestinal parasites of dogs and cats are cosmopolitan pathogens and some of them can affect humans. However, a large number of owners are unaware of this unseen risk to public health. There are two major transmission modes for dog gastrointestinal parasites, namely indirect and direct. The former includes consumption of foods and water contaminated with dogs' secretions and excretions, particularly parasite eggs, cysts, and oocysts, shed through animal faeces into the environment. The latter includes direct contact with dogs since the majority of intestinal parasites have a faecal-oral transmission cycle. Free-roaming (*i.e.*, stray) dogs often exist in urban and rural areas, and their behavioural characteristics such as unrestricted movement within a human environment can easily result in the contamination of the environment (Fayer *et al.*, 2015) [3] Parasitic infestation is characterized by various clinical signs such as retarded growth, diarrhoea with or without blood, vomition, inappetence, lethargy, fever, anaemia, melena and dehydration affecting different breeds, sex and age groups in dogs. *Ancylostoma spp., Uncinaria stenocephala, Toxocara canis, Toxascaris leonina, Trichuris vulpis and Dipylidium caninum* are the major helminths while *Giardia*, *Cryptosporidium*, *Isospora* spp. *and sarcocystis* spp. are the most prevalent protozoan parasites (Baharmi *et al.*, 2011) [1]. Hookworm, *Ancylostoma caninum* is a blood-feeding intestinal parasitic nematode and can cause zoonotic ancylostomiasis in almost all mammalian hosts including humans (Bowman *et al.*, 2010) [2]. Adult hookworm parasitizes in the intestines of dogs and shed millions of eggs to the environment through feces. In dogs, *A. caninum* is regarded as a leading cause of acute, potentially fatal hemorrhagic enteritis in young puppies (Mulinge *et al.*, 2020) [8]. Large roundworms known as ascarids are common in dogs, especially puppies. The most important species is *Toxocara canis* which is of zoonotic nature and worms can be found in puppies intestine as early as 1 week after birth. *Dipylidium caninum*, most common tapeworm of dogs and cats acquire from eating flea with signs vary from mild diarrhea to malaise, irritability, variable appetite, shaggy coat with or without colic (Schimmel *et al.*, 2011) [10]. Anthelmintic drugs approved for the treatment of *A. caninum* include febantel, moxidectin, milbemycin oxime, fenbendazole and pyrantel (FDA, 2012) [4]. Nevertheless, only few data are available on the occurrence of intestinal parasites in companion animals in this area.

Therefore present study was conducted with the objectives to determine the prevalence of different parasitic infestation in dogs respective of age, breed, sex, and deworming status and to study the level of awareness in pet owners of the zoonotic potential from these parasites through well designed questionnaire

Material and Method

Study area and sampling: The study was conducted on 30 dogs that were registered in small animal medicine section of veterinary clinical complex, LUVAS, Hisar, from July' 2021 to August' 2021. Details of dogs suspected for parasitic infestation were recorded which included breed, age, sex etc. Details of the owner i.e. name, contact number, address etc. were also simultaneously recorded. Complete history of the suspected cases regarding the duration of illness, appetite, frequency of vomition and diarrhoea, colour of vomitus and faeces, deworming and vaccination status was recorded. Thorough physical and clinical examination of the affected dogs was performed. These data were finally put into tabular form in predesigned questionnaire (Appendix 1).

Faecal examination: faecal sample was collected in swab or ask owner to brought sample to next day of therapy. Macroscopic examination was firstly performed for the detection of proglottids of cestodes. Faecal floatation method was used for detection of parasite using saturated salt solution i.e Magnesium sulphate and visualised microscopically under 10x. Other solutions can be used were Zinc sulphate, copper or silver nitrate etc.

Haematological analysis: Approximately 2ml blood was collected aseptically from each dog from cephalic/saphanous vein with 22/24 gauze scalp vein set and poured into a tube coated with K3ethylenediamine-tetraacetic acid (K3EDTA) for hematological examination.

Questionnaire Survey: questionnaire designed to know owner general information on canine and feline intestinal parasites together with their awareness of risks for animal and human health from these parasites was submitted.

Line of treatment: Easypet (Praziquantel 50 mg, Pyrantel pamoate 144 mg and Fenbendazole 500 mg) @ 1tablet per 10kg bwt and Ivermectin (Neomec^{R}) 1ml/ 50kg bwt Dose rate: 200µg/kg s/c. And response to therapy ask after 15 days of therapy.

Results and Discussion

Occurrence of parasitic infestation in dogs

A total of thirty dogs were registered in small animal medicine section of veterinary clinical complex, LUVAS, Hisar from July' 2021 to August' 2021. Incidence of parasitic infestation is depicted in Table 4.1.

Table 1: Prevalence of parasitic infestation in dogs

Total number of suspected dogs	Number of dogs suffering from parasitic infestation	Prevalence (%)
30	7	23.3%

Breed-wise distribution of parasitic infestation in dogs

Breed-wise prevalence of parasitic infestation in dogs is depicted in Table 4.2. Maximum prevalence was recorded in mixed breed (42.85%) followed by Labrador (28.57%), Pug and Rottweiler 14.28% each.

Table 2: Breed wise distribution of parasitic infestation in dogs

Breeds	Total no. of dogs screened	Number of dogs positive	% Positive cases W.R.T total positive cases
Mixed breed	10	3 (30%)	42.85
Labrador	7	2(28.57%)	28.57
Pug	5	1 (20%)	14.28
Rottweiler	2	1 (50%)	14.28
German Shepherd	4	0	0
Spitz	2	0	0
Total	30	7	100%

Age wise distribution of parasitic infestation in dogs

Age wise prevalence of parasitic infestation in dogs is depicted in Table 4.3. Maximum prevalence was recorded in 0-4month age group (57.14%) followed by 4-8 month (28.57%) and 8- 12month (14.28%).

Table 3: Age wise distribution of parasitic infestation in dogs

Age group	Total no. of dogs screened	Number of dogs positive	% Positive cases W.R.T total positive cases
0-4month	14	4 (28.57%)	57.14
4-8month	9	2 (22.2%)	28.57
8-12month	7	1 (14.28%)	14.28
Total	30	7	100%

Gender wise distribution of parasitic infestation in dogs

Gender wise prevalence of parasitic infestation in dogs is depicted in Table 4.4. Maximum prevalence was recorded in males (55.5%) than female dog (44.4%).

Table 4: Gender wise distribution of parasitic infestation in dogs

Gender	Total no. of dogs screened	Number of dogs positive	% Positive cases W.R.T total positive cases
Male	17	4(23.52%)	57.14
Female	13	3(23.07%)	42.85
Total	30	7	100%

Occurrence of canine parasitic infestation on the basis of vaccination and deworming status: Deworming and vaccination status of suspected and affected dogs was depicted in Table 4.5. Based on present study it was revealed

that dogs that were not dewormed were more predisposed to parasitic infestation in comparison to properly dewormed dogs.

Table 5: Occurrence of parasitic infestation on the basis of vaccination and deworming status

Gender	Total no. of dogs screened	Number of dogs positive	% Positive cases W.R.T total positive cases
Complete/Incomplete vaccination	13	2 (15.38%)	28.57
No Vaccination	17	5 (29.41%)	71.42
Total	30	7	100%
Complete deworming	16	1(6.25%)	14.28
No deworming	14	6(42.85%)	85.71
Total	30	7	100%

Clinical profile of dogs suffering from parasitic infestation

Clinical profile of dogs affected with parasitic infestation is depicted in Table 4.6. The most common clinical signs observed were inappetance to anorexia (100%), lethargy (85.71%) and gastroenteritis (71.42%). Out of 30 suspected dogs, 15 dogs were found to have concurrent gastroenteritis.

Table 6: Clinical profile of dogs suffering from parasitic infestation

Status	Total no. of dogs screened	Number of dogs positive	% Positive cases W.R.T total positive cases
Lethargy	27	6 (22.22%)	85.71
Bloody diarrhea	15	5 (26.6%)	71.42
Melena	9	3 (33.33%)	42.85
Vomiting	20	5 (25%)	71.42
Fever	17	2 (11.76%)	28.57
Anorexia- inappetance	29	7(24.13%)	100
Pale mucous membrane	19	3 (15.78%)	42.86
Dehydration	23	4 (17.39%)	57.14

Hematological alterations (Mean ± S.E.) in dogs suffering from canine parasitic infestation

Haematological analysis revealed significant decrease in haemoglobin mean value along with significant increase neutrophil count. Key reason for anemia in *ancylostomiasis* might be due to infected larvae secrete a molecule (Ac-asp-2) related to venom allergens in response to host-specific signals which is most powerful natural anticoagulant that exist (Hawdon *et al*., 1999) [5]. Increase neutrophil count in present study might be due to concurrent systemic infection.

Table 7: Shows tparameters dogs suffering from parasitic infestation (n=7)

Parameters	Dogs suffering from parasitic infestation (n=7)
Hemoglobin (gm/dl)	10.37±0.69
TLC (m/mm3)	17.02±0.54
Neutrophil (%)	82.17±2.95
Monocyte (%)	2.50±0.72
PCV (%)	34.83±2.73
Lymphocyte (%)	24.17±3.61
Haemoprotozan	1 positive (Hepatozoon canis)

Prevalence of different intestinal parasite

Elongated, thin shelled oval shaped eggs of *Ancylostomum caninum* visible in seven out of thirty faecal samples using floatation technique as shown in figure 1.

Table 8: Shows prevelance of different intestinal parasite

Gastro- intestinal parasite	Number of positive dogs	Prevalence (%)
Ancylostomum caninum	7	7/30= 23.3

Table 9: Therapy regimen in affected dogs

Drugs	Dose rate	Number of dogs prescribed
Easypet (Praziquantel 50 mg, Pyrantel pamoate 144 mg and Fenbendazole 500 mg)	1 tablet per 10kg bwt	2
Ivermectin (Neomec)	1ml/ 50kg bwt Dose rate: 200µg/kg s/c	5 (because concurrent gastroenteritis)

Response to therapy

Telephonically, therapy response was asked from pet owners after 15 days. Six out of seven affected dogs were completely recovered. One of them was expired because of concurrent parvovirus infection as there is no vaccination and deworming before.

Questionnaire designing and findings

Response given by pet owner was recorded in predesigned questionnaire at time of examination as depicted in Table 4.10. These findings conclude that there is tremendous need of creating awareness among pet owners by organising different awareness compaigns.

Table 10: Different findings observed in Questionnaire

Questions		
1 Owners know some parasites are of zoonotic concern?	No of owner aware	No of owner not aware (%)
	1 (3.33%)	29 (96.66%)
2. Place to discard faecal material?	Open	Dustbin
	23 (76.66%)	7 (23.33%)
3. Bathing schedule	Irregular schedule (almost daily)	Regular schedule
	21 (70%)	9 (30%)
4. Wash hands after handling	Yes, regularly	Not
	19 (63.33%)	11 (36.66%)
5. How frequently perform general health check-up?	Not	Yes (biannually)
	29 (96.66%)	1 (3.33%)
6. Licking habit or Pica	Yes	No
	13 (43.33%)	17 (56.66%)
7. Type of diet given	Homemade	Commercial pedigree
	21(70%)	9(30%)
8. Knowledge about vaccination or deworming schedule?	Yes	No
	4 (13.3%)	26(86.6%)
9. Any other supplement given?	Yes	No
	3 (10%)	27 (90%)
10. Type of housing?	Single	Kennel
	23 (76.66%)	7 (23.33%)

Results of this survey showed that intestinal parasites are common finding in dogs and not to be underestimated. Further, when a dog or a cat is presented to clinical examination on account of gastrointestinal signs, intestinal parasite infection should be considered as a possible differential diagnosis. This condition can be asymptomatic and can even affect animals under proper prophylaxis, thus even apparently fit and healthy pets should be submitted to annual or biannual faecal examination. Male, mixed breed dogs within 0-4 month age groups were found to be predominantly affected in present study. However with this number of sample, we cannot interpret definitive diagnosis. So this study should be continue further on large number of cases. Questionnaire findings gave unexpected results and interpret that there is great need of increasing awareness and knowledge of pet owners about canine gastrointestinal parasites as to their infection routes, proper monitoring and correct behaviour to avoid potential zoonotic risks. Zanzani *et al*., 2014 conducted study to know owner awareness mainly about zoonotic potential of intestinal parasites affecting their pets in Metropolitan and Micropolitan Areas of Northern Italy and found that only 49.19% of pet owners showed to be aware of the risks for human health from canine and feline intestinal parasites. Khansal *et al.*, 2017 conducted study on total of 450 samples of fresh dog faeces between June and November 2015 to determine the prevalence of gastrointestinal parasites in dog faeces in Iran and found parasites in 86 (19.1%) faecal samples. *Sarcocystis* spp. (7.3%), *Taenia/Echinococcus* spp. (5.6%), *Toxocara* spp. (1.8%), and *Cystoisospora* spp. (1.6%) were the most common parasites observed.

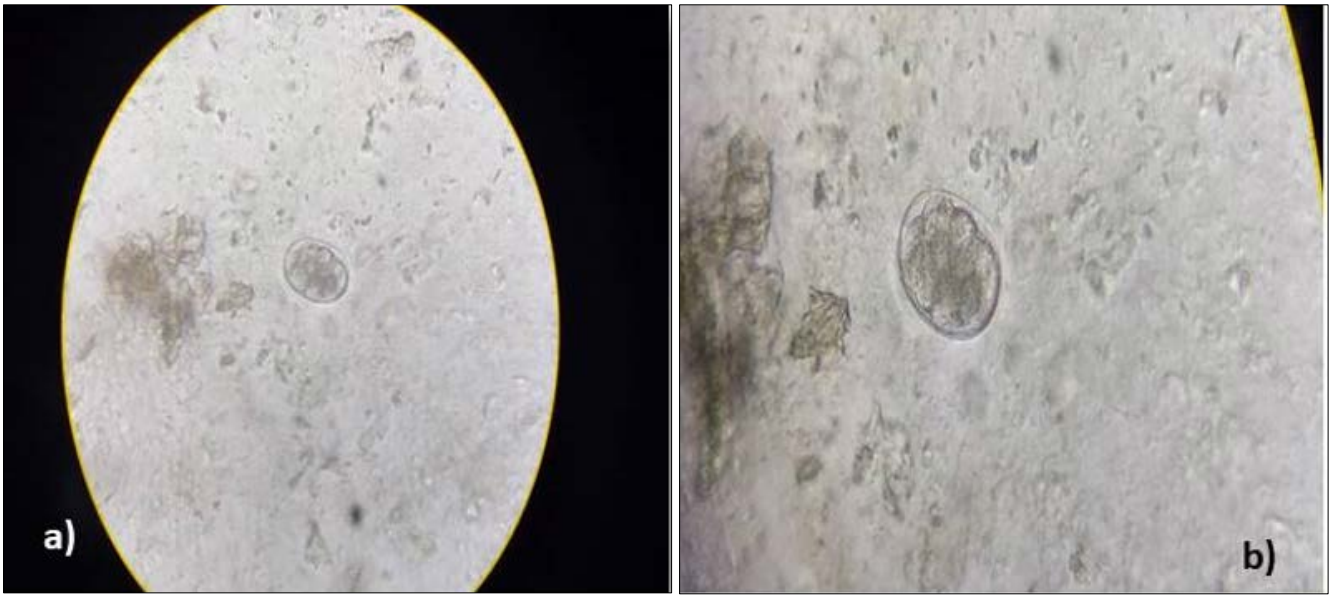

Fig 1: a and b Thin shelled, oval shaped eggs of Ancylostomum caninum

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