RESEARCH ARTICLE

Epidemiology of Canine Gastrointestinal Parasites in Central Plain Zone of Punjab

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Abstract

The aim of this study was to explore, the epidemiology of gastro-intestinal parasites and its associated risk factors affecting canine population of the central plain zone of Punjab, India. The faecal samples were collected form 525 dogs and were subjected to conventional parasitological techniques to identify parasitic oocysts and/or eggs. The overall occurrence of 60.2% was observed which comprised of 53.3% of individual parasitic infection and 6.9% of mixed parasitic infections. The hookworms (31.24%) were found to be predominant enteric parasite followed by *Toxocara* (11.43%), *Dipylidium* (3.81%), Coccidia (3.43%), Taeniids (2.29%) and *Trichuris* (1.14%), whereas mixed infection of gastrointestinal parasites was 6.86%. The associated risk factor analysis for the occurrence of enteric parasites revealed significantly higher infection in non-descript (70.67% vs 56.47%), stray (64.38% vs 54.94%), non-dewormed (74.26% vs 48.61%) and urban (63.86% vs 54.41%) dwelling dogs compared to well defined, pet, dewormed and rural dogs, while a non-significant association was observed in young (62.7% vs 56.54%), female (62.75% vs 57.91%) and non-vaccinated dogs (63.14% vs 41.46%) compared to older, male and vaccinated dogs, with higher seasonal prevalence in winter than summer and monsoon (63% vs 57.41%). The current study is an attempt towards a systematic epidemiological report from different districts which would be helpful in the control and mitigation of the gastrointestinal parasitism in dogs, which might act as a potential public health concern.

Key words: Central plain zone, Dogs, Epidemiology, Gastrointestinal parasitism, Public health concern, Punjab.

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Introduction

The enduring connection between dogs and humans has resulted in their widespread presence across various cultures worldwide. Dogs can serve as reservoirs, transmitters, and carriers of various zoonotic enteric parasites, posing a significant public health concern (Robertson and Thompson, 2002). In pet dogs that are prophylactically treated with anthelmintics the gastrointestinal parasites play a minor role in causing disease, whereas in the free roaming stray dogs having unrestricted movement in human dwellings, it remains a matter of concern as they facilitate spread of gastrointestinal parasitism by contaminating the environment for both humans and owned pet dogs. While sporadic reports of canine enteric parasites from different regions of the country exist (Panigrahi *et al.,* 2014; Kumar *et al.,* 2015; Uppal, 2015; Moudgil *et al.,* 2016; Kurumadas *et al.,* 2020; Dhandapani *et al.,* 2021), there is a lack of sufficient epidemiological data from the central plain zone of Punjab. Hence, this study was conducted to evaluate the systematic epidemiology of enteric parasites, along with the associated risk factors, in the dog population of Punjab, India.

Materials and Methods

The central plain zone has huge plain area with fertile soil among six other agro-climatic zones of the Punjab, India. The region of central plain zone in Punjab spans approximately from latitude 30.5°N and 32.5°N upto longitude 74°E and 76°E. The districts included in the central plain zone of Punjab are Amritsar, Jalandhar, Kapurthala, Ludhiana, Fatehgarh sahib, Patiala, Sangrur, and Tarn Taran (Chaba, 2021). The climatic diversity in central plain zone comprises of hot and dry summers, a distinct monsoon season, cool winters, and transitional periods.

Design of Study and Sampling Procedure

During the month of November 2021 to March 2023, a total of 525 canine fecal samples were gathered, comprising of 267 samples from pet dogs and 258 samples from stray dogs. The study included faecal samples from stray dogs found

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near residential areas, slaughterhouses, animal postmortem houses, animal birth control centers (ABC) and other non-government organizations providing shelter to the dogs. For pet dogs, faecal samples were collected from Multispecialty Veterinary Hospital, Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana, and various private pet clinics and polyclinics located in the respective districts of the central plain zone of Punjab. For the comprehensive representation of parasitism, the assessment of risk factors encompassed various aspects such as age, gender, breed, season, type of domestication, vaccination, deworming status and the impact of urbanization.

The faecal samples were collected from the dogs either per-rectally or the fresh faecal samples from the ground. In some faecal samples intact helminths were procured and kept in 70% ethanol. The presence of egg/oocyst stages related to enteric parasites was examined using microscopy following the traditional parasitological techniques such as the direct smear method and floatation concentration technique, utilizing saturated salt solution (Soulsby, 1982). On the basis of morphology, the parasites were identified.

Statistical Analysis

For the statistical analysis of various risk factors, data compiled in MS Excel was processed using R Studio version 4.1.0 (https://cran.r-project.org/bin/windows/base/old/4.1.0/R-4.1.0-win.exe). The univariable logistic regression analysis (backward stepwise) was used to establish association between risk factors and occurrence of GI parasites along with determination of odds ratios with its 95% confidenceinterval.

Results and Discussion

Prevalence of GI Parasites

The results of faecal examination revealed an overall occurrence of 60.2% GI parasitism in dogs of central plain zone of Punjab. The highest positive percent for single infection was recorded as 53.33, among which the predominant species was hookworms (31.24%), followed by *Toxocara* (11.43%), *Dipylidium* (3.81%), Coccidia (3.43%), Taeniids (2.29%) and *Trichuris* (1.14%), whereas mixed infection of GI parasites was 6.86%. The district wise occurrence of gastrointestinal parasites was highest in Amritsar (70.97%) followed by Ludhiana (69.79%), Jalandhar (66.25%), Tarn Taran (65.75%), Sangrur (55.17%), Fatehgarh Sahib (46.81%), Kapurthala (46.67%) and least in Patiala (45.31%) (Table 1). This is perhaps the first report of systematic epidemiology of canine GI parasites from central plain zone of Punjab. However, 44.34%, 27.8% and 26.09% of prevalence was observed from Chandigarh and Ludhiana districts of Punjab by Utaaker *et al.* (2018), Uppal (2015) and Singh *et al.* (2012), respectively. The difference in the prevalence may be due to the difference in number of dog faecal samples collected and narrow location selection.

The prevalence of canine gastrointestinal (GI) parasitism in India shows significant regional variation, with recent studies reporting 23.72% in Tamil Nadu (Dhandapani *et al.,* 2021), 39% in Kerala (Gayathri and Soya, 2018), and 52.2% in Andhra Pradesh (Kurumadas *et al.,* 2020). In the north, it ranged from as low as 5.71% in Jammu (Shah *et al.,* 2017) to as high as 90.7% in Mathura (Sudan *et al.,* 2015). Central India saw prevalence rates from 27.08% (Qadir *et al.,* 2012) to 79.62% (Nath *et al.,* 2011), while western India showed a wide range up to 88% in Jodhpur (Kachawha and Tanwar, 2007). Globally, recent studies reported prevalence of 97% in Sri Lanka (De Silva *et al.,* 2021), 77.71% across Southeast Asia (Nguyen *et al.,* 2022), and 87% in Europe (Tull *et al.,* 2022). In Africa, prevalence remained high at 56% (Dubie *et al.,* 2023). Widespread variation in prevalence among different regions and countries could be due to variable climatic conditions, stray/pet dog population etc.

Risk Factor Analysis

The univariate logistic regression (Table 2) for various risk factors in backward direction revealed of 1.5 times more occurrence for canine enteric parasites in age group below 6 months (p=0.055). This aligned with the findings of Moudgil *et al.* (2016), Panigrahi *et al.* (2014), and Sudan *et al.* (2015),

Table 1: The overall district-wise occurrence of canine gastrointestinal parasites in central pain zone of Punjab

Districts	No.	Positive	Hookworm	*Toxocara*	Taeniids	*Trichuris*	Coccidia	*Dypilidium*	Mixed
Amritsar	62	44	19	10	2	1	4	2	6
Fastehgarh Sahib	47	22	13	1	1	0	3	0	4
Jalandhar	80	53	25	14	3	1	0	4	6
Kapurthala	45	21	11	4	0	1	1	1	3
Ludhiana	96	67	34	9	5	0	5	7	7
Patiala	64	29	14	4	0	2	3	1	5
Sangrur	58	32	17	10	0	1	1	1	2
Tarn Taran	73	48	31	8	1	0	1	4	3
	525	**316 (60.19%)**	**164 (31.24%)**	**60 (11.43%)**	**12 (2.29%)**	**6 (1.14%)**	**18 (3.43%)**	**20 (3.81%)**	**36 (6.86%)**

which is likely due to the underdeveloped immune system in young animals, their close association with contaminated surroundings, and possible transplacental or transmammary transmission of parasites from infected dams. The similarity may also stem from comparable environmental exposure patterns and management practices in young dogs across regions. However, the non-significant association observed in this study could be due to better early-age deworming practices or a smaller sample size in this age group, limiting statistical power. Additionally, regional differences in parasite species diversity and climatic factors influencing parasite egg survival may explain why some studies, such as Uppal (2015), observed different infection intensities across age categories without statistical significance.

The gender-wise occurrence for different canine enteric parasites was statistically non-significant (p>0.05) and the positive percent was higher in female dogs (62.75%) than male dogs (57.91%). The difference observed in the present study was in agreement with the results of Panigrahi *et al.* (2014), Sudan *et al.* (2015), and Uppal (2015), suggesting that gender alone is not a primary determinant of infection under typical Indian field conditions. The similarity may be due to comparable exposure risks for both male and female dogs in semi-urban or rural areas where no differential management practices exist based on gender. However, contrasting findings in other regions might be linked to physiological stress factors in females (e.g., pregnancy and lactation), which may weaken immunity and contribute to higher parasitic burden, or due to sampling biases in studies focusing on specific subpopulations such as pregnant or lactating bitches.

Among the breeds dwelling in central plain zone of Punjab, a statistically significant (p=0.00) observation with highest infection for canine enteric parasites was recorded from wandering non-descript dogs (70.67%) than descriptive dogs. This significant association of higher infection in non-descript dogs' mirrors findings by Panigrahi *et al.* (2014), Uppal (2015), and Kumar *et al.* (2015). This similarity is reasonably attributed to non-descript dogs' free-roaming behaviour, lack of routine veterinary care, and higher environmental exposure to infective stages. In contrast, descript or purebred dogs are often confined, regularly dewormed, and better managed. Variations in results between studies might arise due to regional differences in dog-keeping practices, with some areas possibly having higher awareness and better care for even non-descript animals, especially if they serve functional roles (e.g., security or livestock herding).

The seasonal occurrence of canine gastrointestinal parasites was statistically significant with highest percent in winter (66.86%) as compared to summer (57.65%) and monsoon (56.45%). The observation as seen in the current study, differs from reports by Uppal (2015), Moudgil *et al.* (2016), and Abhiram *et al.* (2019), who noted peak prevalence during the summer or monsoon. This divergence may be attributed to climatic variability across regions - cooler winters in Punjab may promote longer survival of infective stages in the environment due to slower desiccation,

Table 2: The univariate logistic regression for various risk factors in backward direction for occurrence of canine gastrointestinal parasites in central pain zone of Punjab

Risk factors	**Criteria**	**No.**	**Positive (%)**	**Odds Ratio**	**95% CI**	***p* value**
Gender	Male	278	57.91	0.817	0.575-1.160	0.258
	Female[#]	247	62.75	1.0	-	-
Age	0-6 months	133	66.92	1.555	0.990-2.441	0.055*
	6-12 months	178	59.55	1.132	0.756-1.694	0.548
	>12 months[#]	214	56.54	1.0	-	-
Breed	Descript	317	56.47	0.474	0.327-0.687	0.000*
	Non-Descript[#]	208	70.67	1.0	-	-
Season	Summer	170	57.65	0.675	0.434-1.049	0.081*
	Monsoon	186	56.45	0.642	0.417-0.990	0.045*
	Winter[#]	169	66.86	1.0	-	-
Domestication status	Pet[#]	233	54.94	1.0	-	-
	Stray	292	64.38	1.5	1.043-2.109	0.028*
Vaccination status	Vaccinated	232	41.46	0.757	0.533-1.076	0.121
	Non-Vaccinated[#]	293	63.14	1.0	-	-
Deworming status	Dewormed	288	48.61	0.328	0.226-0.475	0.00*
	Non-Dewormed[#]	237	74.26	1.0	-	-
Effect of urbanization	Rural	204	54.41	0.666	0.466-0.953	0.026*
	Urban[#]	321	63.86	1.0	-	-

*Significant at level 0.01; [#]reference category.

whereas in hotter regions, parasites may thrive better during humid monsoon months. Differences in sampling times, parasite species involved, and their respective life cycles could also explain this variation. Additionally, the abrupt climatic fluctuations due to climate change may have altered traditional seasonality patterns of GI parasite transmission in recent years.

A non-significantly ($p>0.05$) higher infection of 63.14% was observed in non-vaccinated dogs in contrast to vaccinated dogs (56.47%). There was a significant ($p=0.000$) probability of non-dewormed dogs (74.26%) to be infected with GI parasites in contrast to dewormed dogs (48.61%). The finding was in strong agreement with Satyal *et al.* (2013), Kamani *et al*. (2021), and Uppal (2015), highlighting the effectiveness of prophylactic veterinary practices. Similarity across these studies can be explained by the universal impact of anthelmintics and vaccines in reducing parasitic load. Any variations observed in other reports could be due to irregular dosing, use of substandard dewormers, resistance development, or under-reporting of owner compliance with health interventions.

The effect of urbanization was statistically significant ($p=0.026$) and more prominent in urban dogs (63.86% vs 54.41%). The present finding supported the earlier observations of Uppal (2015) and Kumar *et al.* (2015). The similarity is likely due to stray dogs' increased exposure to contaminated environments, open defecation areas, and lack of veterinary care. Urban areas, despite offering better access to veterinary services, also face challenges such as higher dog density, improper waste disposal, and limited control over stray dog populations, which facilitate parasite transmission. Differences in prevalence between regions may be due to variable urban infrastructure, differing levels of community engagement in animal welfare, or region-specific canine population dynamics.

Conclusion

The central plain zone of Punjab exhibits a noteworthy higher occurrence of enteric parasites in canines, specifically hookworms thereby indicating a risk of zoonotic cutaneous larva migration in the region. The presence of faecal matter in urban settings, such as sidewalks or parks, creates an environment conducive to the transmission of enteric parasites. A higher degree of human-dog interaction in urban setting may enhance the opportunities for direct or indirect transmission of enteric parasites between dogs, thereby facilitating the spread of infections. The present research work is a systematic epidemiological study of canine gastrointestinal parasites in central plain zone of Punjab in relation to associated risk factors and will be helpful in control of gastrointestinal parasitic diseases in dogs in the region.

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