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ORIGINAL ARTICLE

Clinico-epidemiological investigation of feline panleukopenia and parvoviral enteritis in the two largest pet hospitals in Bangladesh

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ABSTRACT

Objective: A clinico-epidemiological study was conducted at two veterinary hospitals in Dhaka to evaluate the prevalence of parvoviral enteritis (PVE) in dogs and feline panleukopenia (FPL) in cats, to detect factors associated with them, and to identify their common clinical signs.
Materials and Methods: Clinico-epidemiological data were collected for a total of 88 dogs and 129 cats which were presented to the hospitals, entered into MS excel 2010, and then transferred to STATA-14 software for conducting descriptive and univariable statistical analyses (Fisher's exact test). The maps showing the spatial distribution of PVE and FPL were produced by using QGIS software version 2.18.13.
Results: PVE in dogs and FPL in cats had the highest prevalence compared to other diseases (34.1%; 95% confidence interval: 24.3–44.9; *N* = 88 and 20.2%; 95% confidence interval: 13.6–28.1; *N* = 129, respectively). Young age (43.8%), poor body condition (58.4%), and exotic breeds (44.2%) were significantly associated with the occurrence of PVE ($p \leq 0.05$). Poor body condition (27.8%) and non-vaccination status (26.7%) were associated with FPL ($p \leq 0.05$). Both PVE and FPL showed clinical signs of being off-feed, frequent vomiting, weakness, and moderate dehydration.
Conclusion: The high prevalence of PVE and FPL indicates that they are common in dogs and cats in Dhaka, Bangladesh. The factors related to PVE are young age, exotic breed, and poor body condition score (BCS), and FPL are poor BCS and non-vaccination. Specific measures such as care during younger age, good nutrition, and routine vaccination are needed to prevent and control PVE and FPL in Dhaka's dog and cat population.

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Introduction

As economic conditions and veterinary services improve in Bangladesh, private ownership of dogs and cats has significantly increased. Both local (non-descriptive indigenous) and exotic breeds (foreign breeds) of dogs and cats are owned by pet lovers. German shepherd dogs and Persian cats dominate among the exotic breeds. Simultaneously, there are also other breeds like Spitz, Rottweiler, Lhasa apso, Golden retriever, and Labrador retriever among dogs, and Himalayan, Turkish, and British short hair among cats. However, there are very insufficient data for viral diseases of dogs and cats in Bangladesh. The limited studies reveal that canine parvovirus (CPV) and feline panleukopenia (FPL) are two clinically important viruses affecting domestic dogs and cats having a 22%–30% prevalence in pet dogs [1,2] and 7.5% prevalence in pet cats in Bangladesh [3].

Canine parvoviral enteritis (PVE) is caused by the viral strains CPV2a, CPV2b, and CPV2c belonging to parvovirus type 2 (CPV-2) and *Protoparvovirus* type 1 species. The *Protoparvovirus* genus and Parvoviridae family emerged in the 1970s [4,5]. The virus spreads through the feces of affected dogs having high morbidity (100%), 10% mortality [6], and up to 90% fatality [2]. Dogs affected by CPV are usually characterized with fever, anorexia, lethargy, depression, vomiting, mucoid to hemorrhagic diarrhea, and sometimes leukopenia [18]. Significant factors associated

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with CPV disease worldwide include being younger than 5 months old, male, breeds such as Alsatians, Mongrels, Rottweiler, and indigenous dogs, non-vaccinated, and dry season [1,3,7,8].

FPL is a highly contagious viral disease affecting domestic and wild felids. FPL belongs to the species *Parvovirus* and subgroup FPV [9]. Both CPV and FPV come from the same family and are closely related. Truyen and Parrish [10] found that CPV replicates in both canine and feline cells, whereas FPV replicates efficiently only in feline cells. The virus is acquired through the oro-nasal route [11]. The disease is clinically manifested by severe depression, vomiting, dehydration, diarrhea, and a marked decrease in circulating white blood cells [11]. Depending on the severity of clinical signs, mortality ranges from 25% to 100% [11]. Limited studies are available on prognostic and risk factors of naturally occurring FPL in cats [12].

Despite the clinical importance of PVE and FPL and the growing interest in dogs and cats as pets, information about the prevalence and factors associated with PVE and FPL in Bangladesh is insufficient to advise veterinarians and pet owners properly. Therefore, the present study was conducted during the clinical rotation of the Doctor of Veterinary Medicine (DVM) internship program on pet diseases, and a focus was given to PVE in dogs and FPL in cats to understand the epidemiological features and clinical diagnosis of the two diseases.

The present clinico-epidemiological investigation objectives were to i) estimate the prevalence of the disease and disease conditions in dogs and cats presented at the two hospitals, ii) identify potential factors associated with PVE and FPL, and iii) identify common clinical signs of the two diseases.

Materials and Methods

Ethical statement

Written consent was taken from the respective persons in charge of the hospitals. Oral consent was taken from each participant (pet owner) before the interview.

Study location and duration

A 2-month DVM internship clinical rotation was completed at two major pet hospitals in Bangladesh: the Central Veterinary Hospital (CVH), Dhaka (December 2018), and the Teaching and Training Pet Hospital and Research Centre (TTPHRC) at CVASU, Dhaka (January 2019). The present study was conducted as a part of the 1-year internship program within this period, and so these 2 months could be sampled only.

Study design and cases

During the rotation, a total of 88 dogs and 129 cats (both healthy and unhealthy) of different breeds were presented (101 to CVH and 116 to TTPHRC) to the hospitals. All these dogs and cats were included in the study population and divided into different groups such as bacterial, viral, fungal, parasitic, nutritional, and others. (e.g., vaccination, routine check-up, etc.). According to the diagnosis, all the groups were subdivided into specific case categories (e.g., abscess, parvoviral enteritis, dermatophytosis, etc.). If any dog or cat brought for routine check-up/deworming/vaccination was diagnosed with any disease or disease condition, it was then recategorized into a specific disease category. The cases for PVE in dogs and FPL in cats were diagnosed based on clinical diagnosis. Experienced pet veterinarians assessed all the cases in this study.

Recording of clinical and epidemiological data

A structured record-keeping sheet was prepared for the collection of data. After initial registration and history taking, each case underwent clinical examination. Clinico-epidemiological findings of each case were recorded in either the hospital register book or the structured record-keeping sheet. Data included address, date, housing system, species, breed, age, sex, body weight, body condition score (BCS), vaccination, deworming, previous diseases, duration of illness, defecation, urination, vomiting, and client demographic information (age, sex, education, and job). Clinical examinations included pulse, respiration, rectal temperature (°F), skinfold test, the examination of mucous membranes (normal/pale/congested/icteric), abdominal palpation, percussion, auscultation and other tests relevant to the primary complaint.

Diagnosis and drug prescription data were also recorded in the registered book or the structured record-keeping sheet. Pharmaceutical data (only for PVE and FPL) consisted of drug names, main and supportive drugs, dose, route, and duration. However, pharmaceutical data were not used for this paper.

Diagnosis of cases

Case diagnostics were carried out based on clinico-epidemiological and laboratory (wherever necessary or possible) findings. Common laboratory tests included coproscopy (for parasitic egg identification), radiology (for fracture confirmation), ultrasonography (for pregnancy diagnoses and reproductive abnormalities), skin scrapings (for mites and dermatophytes), and blood examination (for blood protozoa). As antigen test kits were not available in the hospitals, any confirmatory diagnosis could not be made for PVE in dogs and FPL in cats.

Ortega et al. [5] examined 50 dogs with PVE like clinical signs under the polymerase chain reaction, and 38 came out positive, which means 76% of the dogs showing signs were positive for CPV. On the other hand, 80% of diseased cats having FPL like clinical signs were positive for feline parvovirus under PCR, according to Stuetzer and Hartmann [11].

In the above circumstances, the diagnosis of PVE and FPL was made based on the history and clinical examination. The case definitions for the clinical cases of PVE and FPL used in this study were as below.

Parvoviral enteritis: An individual dog with the clinical signs of frequent vomiting, diarrhea, foul smelly mucoid to hemorrhagic feces, and fever or hypothermia along with anorexia and weakness was defined as a PVE case [13].

Feline panleukopenia: An individual cat with the clinical signs of anorexia, frequent vomiting, weakness, dehydration, subnormal temperature, and diarrhea was defined as an FPL case [2,14].

Data management and analysis

All data obtained (88 dogs and 129 cats; 101 from CVH and 116 from TTPHRC) were entered into Microsoft Excel 2010, USA (MS Excel 2010). Data were cleaned, sorted, and coded in MS Excel 2010 before exporting to STATA-14 (Stata Corp, 4905, Lakeway Drive, College Station, Texas 77845, USA) for descriptive and univariable statistical analysis. The prevalence of different diseases or disease conditions was calculated using each category's number divided by the total number of cases of all categories, according to species (cat/dog). Frequency distribution of cases (PVE/FPL) was presented according to categories of each selected factor (duration of illness, vomiting, dehydration, feces consistency, weakness, temperature, gait, and feeding habit).

Fisher's exact test was carried out to assess associations between the categorized response variable of PVE/FPL and the selected independent variables (breed, gender, age, BCS, and vaccination). The results were expressed in frequency number, percentage, and p-value. The significant difference in the proportion of cases between different categories of independent variables was ascertained by a p-value of ≤ 0.05. The calculation of 95% confidence intervals was done using the binomial approximation.

The distribution of parvoviral enteritis, FPL, and other cases is shown in Figures 1 and 2. The figures were produced by collecting spatial data from an online portfolio GPS Geoplaner [15], and analysis of spatial data was done by using QGIS software version 2.18.13 [16].

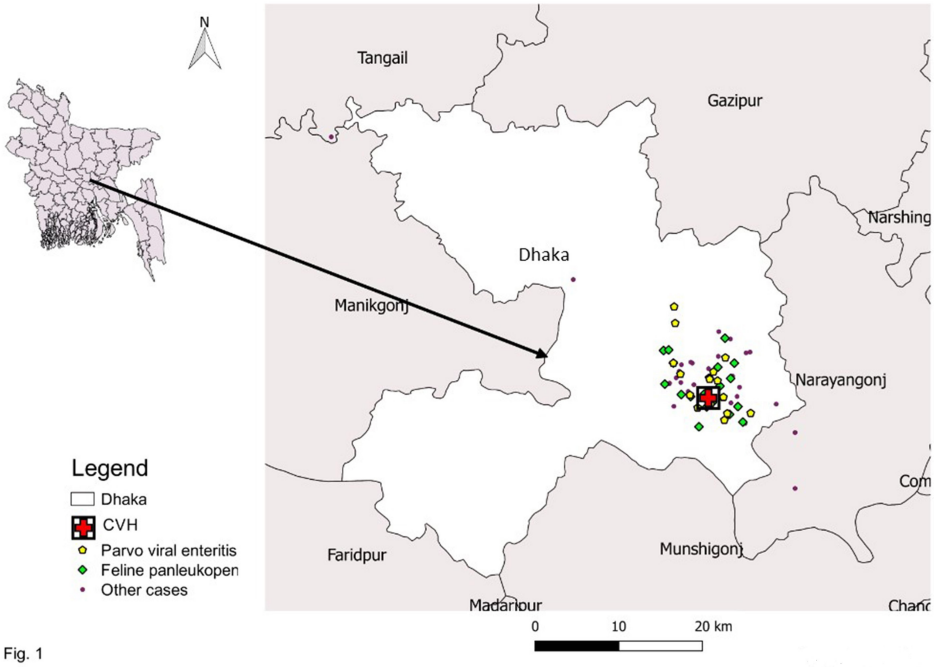

Figure 1. Spatial distribution of parvoviral enteritis, feline panleukopenia, and other cases presented to Central Veterinary Hospital (CVH), Dhaka.

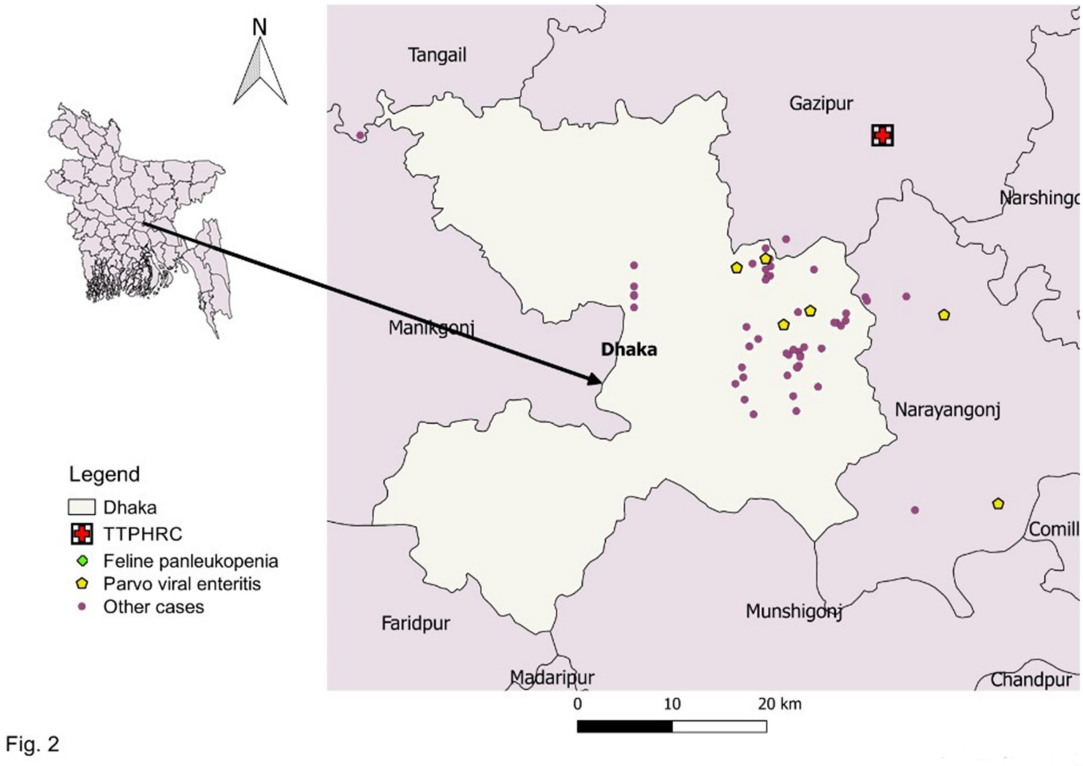

Fig. 2

Figure 2. Spatial distribution of parvoviral enteritis, feline panleukopenia, and other cases presented to the Teaching and Training Pet Hospital and Research Centre (TTPHRC), Purbachal, Dhaka.

Results

PVE (34.1%; 95% CI 24.3%–44.9%) (Table 1) and FPL (20.2%; 95% CI 13.6–28.1) (Table 2) had the highest prevalence among dogs and cats, respectively, during this period of study (December 2018 to January 2019).

Exotic breeds (44.2%), dogs less than 5-month old (43.8%), and dogs having a BCS of 1–2 (58.8%) had higher prevalence compared with local breeds (19.4%), dogs older than 5 months (22.5%), and dogs having a BCS of 3–4 (18.5%), respectively ($p < 0.05$) (Table 3). The prevalence of FPL was significantly higher in cats having a BCS of 1–2 (27.8%) and in unvaccinated cats (26.7%) compared with cats having a BCS of 3–4 (2.6%) and vaccinated cats (5.1%), respectively ($p < 0.05$) (Table 3).

Vomiting occurred in 70% of the cases of PVE and 76.9% of the cases of FPL. Most of the cases were moderately dehydrated (50% in PVE and 38.5% in FPL). Fecal consistency was mostly bloody diarrhea (63.3%) in PVE and normal (69.2%) in FPL. Weakness was present in 80% of PVE cases and 65.8% of FPL cases. The temperature was mostly normal (66.7%) in PVE and subnormal (38.5%) in FPL. Gait was normal in most of the cases (82.9% in PVE and 88.5% in FPL), while 7.9% of the cases of PVE and 7.7% of the cases of FPL were recumbent, only one FPL patient (3.9%) showed a convulsive gait. 86.7% of PVE cases were anorectic, and all FPL cases (100%) were anorectic (Table 4).

Discussion

The current study explored the prevalence and identified factors of PVE and FPL and identified common clinical signs of the two diseases in pet dogs and cats in two large veterinary hospitals in Bangladesh.

PVE had the highest prevalence (34.1%) among dogs than other diseases, which is because PVE is endemic in dogs in Bangladesh and neighboring countries [1,17,18]. Islam et al. [1] assessed a 30% prevalence of PVE in dogs in Mymensing, which is near the Dhaka district, and this prevalence is very close to the findings of this study.

FPL is an endemic disease in cats, and a high level of FPL was expected [2,11,19], which supports the finding of the present study. The prevalence of PVE was significantly higher in the exotic dog breeds, which is consistent with other studies [3,8,20]. No specific comments can be made on the less susceptibility of local nondescriptive dogs as the

Table 1. Frequency distribution of different case categories in dogs presented at the veterinary hospitals in Dhaka (from December 3, 2018 to January 31, 2019, *N* = 88)

Groups	Diseases/Disease conditions	Frequency number	%	95% CI
Bacterial	Abscess	1	1.1	0.03–6.1
	Gastrointestinal tract infection	1	1.1	0.03–6.1
	Peritonitis	1	1.1	0.03–6.1
	Respiratory tract infection	1	1.1	0.03–6.1
Viral	Parvoviral enteritis	30	34.1	24.3–44.9
	Canine distemper	1	1.1	0.03–6.1
	Common cold	1	1.1	0.03–6.1
	Tonsillitis	1	1.1	0.03–6.1
Fungal	Dermatophytosis	2	2.3	0.2–7.9
Parasitic	Flea infestation	2	2.3	0.2–7.9
	Mite infestation	2	2.3	0.2–7.9
	Endoparasitic infestation	1	1.1	0.03–6.1
	Protozoal diarrhea	1	1.1	0.03–6.1
	Tick infestation	1	1.1	0.03–6.1
	Trypanosomiasis	1	1.1	0.03–6.1
Nutritional	Nutritional deficiency	1	1.1	0.03–6.1
Others	Vaccination	13	14.8	8.1–23.9
	Fracture	6	6.8	2.5–14.2
	Routine check-up	6	6.8	2.5–14.2
	Wound	3	3.4	0.7–9.6
	Routine deworming	2	2.3	0.2–7.9
	Pain	2	2.3	0.2–7.9
	Cancer	1	1.1	0.03–6.1
	Central nervous system injury	1	1.1	0.03–6.1
	Inappetance	1	1.1	0.03–6.1
	Neurological disorder	1	1.1	0.03–6.1
	Poisoning	1	1.1	0.03–6.1
	Pregnant	1	1.1	0.03–6.1
	Retracted tendon	1	1.1	0.03–6.1
	Undiagnosed	3	2.3	0.2–7.9

CI = Confidence interval, *N* = Number of cases.

population density of breeds varies from one geographical area to another. Earlier studies found that medium and large breeds are more susceptible to PVE [21,22], which could be the potential reason why German shepherd dogs had more PVE cases in this study.

Younger dogs were more commonly affected by PVE in the present study, supported by many earlier studies [1,3,7,8]. Due to the changes in diet and intestinal bacterial flora after weaning, puppies have a higher mitotic index in intestinal crypt cells. The virus targets rapidly multiplying cells of the intestinal crypts, and so the younger dogs are more susceptible to PVE [23].

Pets with poor BCS had a significantly higher prevalence of PVE (dogs) and FPL (cats), which is consistent with an earlier investigation [1]. Although no relevant study was found to describe this association's reason, it is quite relevant that dogs and cats with poor BCS have weaker immune responses toward infections and vaccination. Off-feed conditions and dehydration during PVE and FPL also decrease body weight and lead to poor body conditions.

Table 2. Frequency distribution of different case categories in cats presented at the veterinary hospitals in Dhaka (from December 3, 2018 to January 31, 2019, *N* = 129)

Groups	Diseases/Disease conditions	Frequency number	%	95%CI
Bacterial	Bacterial diarrhea	2	1.6	0.1–5.4
	Upper respiratory tract infection	1	0.8	0.01–4.2
	Urinary tract infection	1	0.8	0.01–4.2
Viral	Feline panleukopenia	26	20.2	13.6–28.1
	Calici viral infection	2	1.6	0.1–5.4
	Common cold	2	1.6	0.1–5.4
	Feline rhinotracheitis	2	1.6	0.1–5.4
Fungal	Dermatophytosis	1	0.8	0.01–4.2
Parasitic	Endoparasitic infestation	12	9.3	4.8–15.6
	Flea infestation	3	2.3	0.4–6.6
	Mite infestation	2	1.6	0.1–5.4
Nutritional	Nutritional deficiency	11	8.5	4.3–14.7
	Diabetes	1	0.8	0.01–4.2
Others	Vaccination	20	15.5	9.7–22.9
	Routine deworming	7	5.4	2.2–8.8
	Health check-up	7	5.4	2.2–8.8
	Wound	7	5.4	2.2–8.8
	Fracture	6	4.6	1.7–9.8
	Pain	3	2.3	0.4–6.6
	Constipation	2	1.6	0.1–5.4
	Anchylosis	1	0.8	0.01–4.2
	Anorexia	1	0.8	0.01–4.2
	Compact nipple	1	0.8	0.01–4.2
	Congenital defect	1	0.8	0.01–4.2
	Dermatitis	1	0.8	0.01–4.2
	Gastritis	1	0.8	0.01–4.2
	Muscular weakness	1	0.8	0.01–4.2
	Paralysis	1	0.8	0.01–4.2
	Undiagnosed	3	2.3	0.4–6.6

CI = Confidence interval, *N* = Number of cases.

Cats with a positive vaccination status had a lower prevalence of FPL. Vaccination has been found to develop protective immunity against FPL infection in cats in previous studies [24,25].

Off-feed condition, frequent vomiting, weakness, and moderate dehydration were the prominent clinical signs in both PVE and FPL. Bloody diarrhea was common in PVE, and diarrhea was less common in FPL. These clinical signs are well-supported by other study findings [9,13,26]. These clinical signs primarily contributed to diagnosing the two diseases as limited diagnostic facilities are available in the field.

The study was conducted in only two hospitals in Dhaka due to time limitations as the study was a part of the internship program. Therefore, the sample size was not sufficient to conduct a multivariable logistic regression model to determine potential adjusted risk factors associated with the occurrence of PVE and FPL. However, both hospitals cover patients from all over Dhaka and its surrounding areas, thus registering a reasonable number of patients. PVE and FPL diagnoses were mainly made based on history and clinico-epidemiological findings, and the cases were overseen by experienced pet veterinarians.

Table 3. Association between parvoviral enteritis/feline panleukopenia and the selected factors through Fisher's exact test.

Factors	Categories	Parvoviral enteritis		*p*-value	Feline panleukopenia		*p*-value
		Yes (%)	No		Yes (%)	No	
Source	Pet	29 (36.3)	51	0.256	26 (20.5)	101	1
	Rescued	1 (12.5)	7		0 (0)	2	
Breed	Local	7 (19.4)	29	0.022	22 (24.2)	69	0.09
	Exotic	23 (44.2)	29		4 (10.5)	34	
Gender	Male	23 (35.4)	42	0.800	10 (17.2)	48	0.51
	Female	7 (30.4)	16		16 (22.5)	55	
Age (Month)	<5m	21 (43.8)	27	0.044	17 (23.6)	55	0.37
	>5m	9 (22.5)	31		9 (15.8)	48	
BCS	1-2	20 (58.8)	14	<0.001	25 (27.8)	65	0.001
	3-4	10 (18.5)	44		1 (2.6)	38	
Vaccination	Yes	7 (26.9)	19	0.462	2 (5.1)	37	0.004
	No	23 (37.1)	39		24 (26.7)	66	

BCS = Body condition score, *p* = Provability.

Table 4. Frequency distribution of observable clinical signs of canine parvoviral enteritis (N = 30) and feline panleukopenia (*N* = 26) cases.

Variable/Signs	Parvoviral enteritis *n* (%)	Feline panleukopenia *n* (%)
Vomiting, yes	21 (70)	20 (76.9)
Dehydration		
Normal	0 (0.0)	3 (11.5)
Mild	14 (46.7)	7 (26.9)
Moderate	15 (50)	10 (38.5)
Severe	1 (3.3)	6 (23.1)
Consistency of feces		
Normal	7 (23.3)	18 (69.2)
Diarrhea	4 (13.3)	5 (19.2)
Bloody diarrhea	19 (63.3)	3 (11.5)
Weakness, yes	24 (80)	17 (65.8)
Temperature		
Subnormal	4 (13.3)	10 (38.5)
Normal	17 (56.7)	9 (34.6)
Fever	9 (30)	7 (26.9)
Gait		
Normal	28 (82.9)	23 (88.5)
Recumbent	2 (7.9)	2 (7.7)
Convulsive	0 (0.0)	1 (3.9)
Feeding habit, anorectic	26 (86.7)	26 (100)

n = Frequency number, *N* = Number of cases.

Conclusion

The prevalence of PVE and FPL were 34.1% and 20.2%, respectively. The factors associated with PVE were young age, exotic breed, and poor BCS. Poor BCS and non-vaccination were associated with FPL. To prevent the diseases, puppies should be kept in intensive care, and a good plan of nutrition should be maintained for both dogs and cats to prevent these deadly diseases. The study also shows that a proper vaccination schedule is vital to follow. So, this study's findings will aid both pet owners and clinicians in preventing and managing PVE and FPL cases.

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Conflict of interests

The authors declare that they have no conflict of interests.

Authors' contribution

NNC directly took part in the clinical examination, data collection, analysis, and interpretation of data and manuscript writing. MAH designed the study; supervised NNC for collection, analysis, interpretation of data, drafted the manuscript; and critically reviewed the manuscript. JPB, AAS, and SA took part in the critical review and finalization of the manuscript.

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