

Article

Seroprevalence, risk factors, and therapeutic response of feline panleukopenia in household cats at Savar Upazila of Dhaka district in Bangladesh

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Abstract: Feline panleukopenia is a single-stranded DNA virus. It is a highly contagious and often lethal viral infection in cats. The present study aimed to determine the seroprevalence, associated common risk factors, and therapeutic response of the disease in cats in the study area. The disease was diagnosed based on history, characteristic clinical findings, and laboratory diagnosis by a Rapid diagnosis test kit. Information on age, season, sex, and immune status was evaluated to determine the risk factors of feline panleukopenia virus infection in cats. The present investigation showed that 58.33% of cats tested positive for FPV. In addition, cats under the age of six months had a greater incidence of infection (67.12%) than cats between the ages of seven and twelve months (59.18%) and cats over twelve months (38.24%). Winter (68.18%) had a higher prevalence of FPV than summer (52.83%) and rainy (48.65). In the present study, male cats had a higher frequency of FPV (60.49%) than female cats (56%). The non-vaccinated cats exhibited FPV positive (62.96%) compared to vaccinated cats (28.57%). In addition, 42 (46.15%) animals had full recovery from infection. The recovery rate (65.52%) of cats aged 7 to 12 months was higher than that of two other age groups. Additionally, more cats were recovered in the summer season (64.29%) than in the winter (33.33%) or during the rainy season (50%). Compared to non-vaccinated cats (44.71%), FPV-positive vaccinated animals have demonstrated a higher recovery percentage (66.66%). Proper hygienic management and vaccination are important measures to check the FPV infection in cats. The status of the prevalence and associated risk factors is necessary to control the fatal infection of cats in the study area.

Keywords: serological test; associated factors; recovery rate; feline panleukopenia viral infection

1. Introduction

Feline panleukopenia is a highly contagious disease in cats caused by the Feline Panleukopenia Virus (FPV). It is a non-enveloped, icosahedral, single-stranded DNA virus, that infects and kills rapidly proliferating and dividing cells in the intestine, bone marrow, and developing fetus (Lefkowitz *et al.*, 2018). Furthermore, the virus targets the body's quickly proliferating blood cells, mainly those found in the skin, bone marrow, and intestines. The virus's impact on blood cells can result in anemia and a low concentration of white blood cells in circulation (Stuetzer and Hartmann, 2014).

Clinical signs of the illness caused by the disease include diarrhea, vomiting, dehydration, anorexia, and severe depression. Kittens under the age of 12 months have the highest rates of illness and mortality. Acute panleukopenia causes 25–90% of deaths, but per-acute infections can cause 100% of deaths (Stuetzer and Hartmann, 2014). There may be variations in the prevalence of feline panleukopenia among studies conducted globally. It has been reported that the prevalence of Feline panleukopenia infection is 40% and 22.4% in Iraq and Bangladesh, respectively (Islam *et al.*, 2010; Dishow *et al.*, 2023).

The overall prevalence of the disease among suspects cat was 22.9%. The mortality and case fatality were 10.6%, and 45.9%, respectively (Kabir *et al.*, 2023). A population of free-ranging Felid in Brazil that shared a habitat with domestic cats known to carry the FPV was found to have 48% (Munson *et al.*, 2004).

Feline panleukopenia is most common among domesticated, young, immune-compromised, and multi-cat families in enclosed shelters. Younger cats are more likely than older cats to experience FPV. But cats of all ages who are not vaccinated or vaccinated incorrectly may experience it. The disease only struck in vaccinated cats who had not gotten a booster shot after 12 weeks of age, with a median age of 4 months for the affected cats. Nonetheless, the death of kittens has been documented in homes with completely immunized cats, most likely because of exposure to high viral concentrations in the surroundings. There is a seasonal correlation between the number of vulnerable newborn kittens and outbreaks of FPV in cats. Additionally, cats exposed to the outdoors, such as feral, barn, and stray cats, may experience the disease (Kruse *et al.*, 2010).

It is critical to diagnose FPV infections quickly to isolate affected cats and shield susceptible animals from contracting secondary infections. The clinical history and indications alone do not always indicate a diagnosis. Only specialized laboratories can conduct laboratory testing, and the results take longer to obtain. Immunochromatography assay is the fastest field diagnostic technique now employed in clinical practice because of its ease of use and ability to be conducted by both veterinarians and owners (Abdelbaky *et al.*, 2024). The overall relative sensitivity and specificity of diagnostic kits were 44% and 100%, respectively, based on the immunochromatography assay evaluation (Chowdhury *et al.*, 2021).

Since FPV is a viral disease, there is no specific treatment. However, supportive therapy and good nursing care have been shown to reduce mortality rates significantly. Some recommended supportive and symptomatic treatments include antibiotics to control secondary bacterial infections, antiemetic medications, fighting dehydration, restoring electrolyte imbalance, nutritional supplements, and more (Gerlach *et al.*, 2017; Pandey, 2022). Vaccination should be done to prevent the illness. Commercially available vaccines for the virus include modified live virus or inactivated virus vaccines (Bergmann *et al.*, 2018). Two injections, at 8-9 weeks of age and 3-4 weeks later, are advised, as well as a first booster one year later (Truyen *et al.*, 2009). The study area is a satellite area of the capital city of Bangladesh. Nowadays, many people raise cats as their pets. They are unaware of the hygienic management of their pet houses, feeding, and disease management strategies. For this reason, many pets especially cats suffer from various infectious diseases. Among the diseases, FPV infection is very fatal in cats. The investigation of this disease was very limited in Bangladesh. So, the present study was conducted to determine the seroprevalence, associated common risk factors, and therapeutic response of FPV infection in cats in the study area.

2. Materials and Methods

2.1. Ethical approval

This study did not require ethical approval.

2.2. Study area, period, and animal

The study was conducted in the Upazila livestock office and veterinary hospital, Savar, and Supreme Pet Clinic, Savar on 156 cats at Savar Upazila of Dhaka district in Bangladesh from April 2023 to March 2024 (Figure 1). Patients came from different areas of the Dhaka district. The pet cats were kept indoors and looked after by the owners not going outside. The body weight of the cats ranged between 0.45 kg and 4.2 kg. Data were collected from the suspected cats and the disease was diagnosed based on history, clinical signs, and laboratory diagnosis using a rapid diagnosis test kit.

2.3. General clinical examination

General examination was conducted by observing physical condition, measuring temperature, checking dehydration by skinfold test, observing the color of the mucus membrane, and taking the disease history from the owner and the appearance of vomit and feces in the patient. In some affected cats' mucosal pallor, prolonged capillary refill time or rarely hypothermia may also be found. Abdominal palpation may reveal a tubular mass caused by intestinal intussusception (Awad *et al.*, 2018).

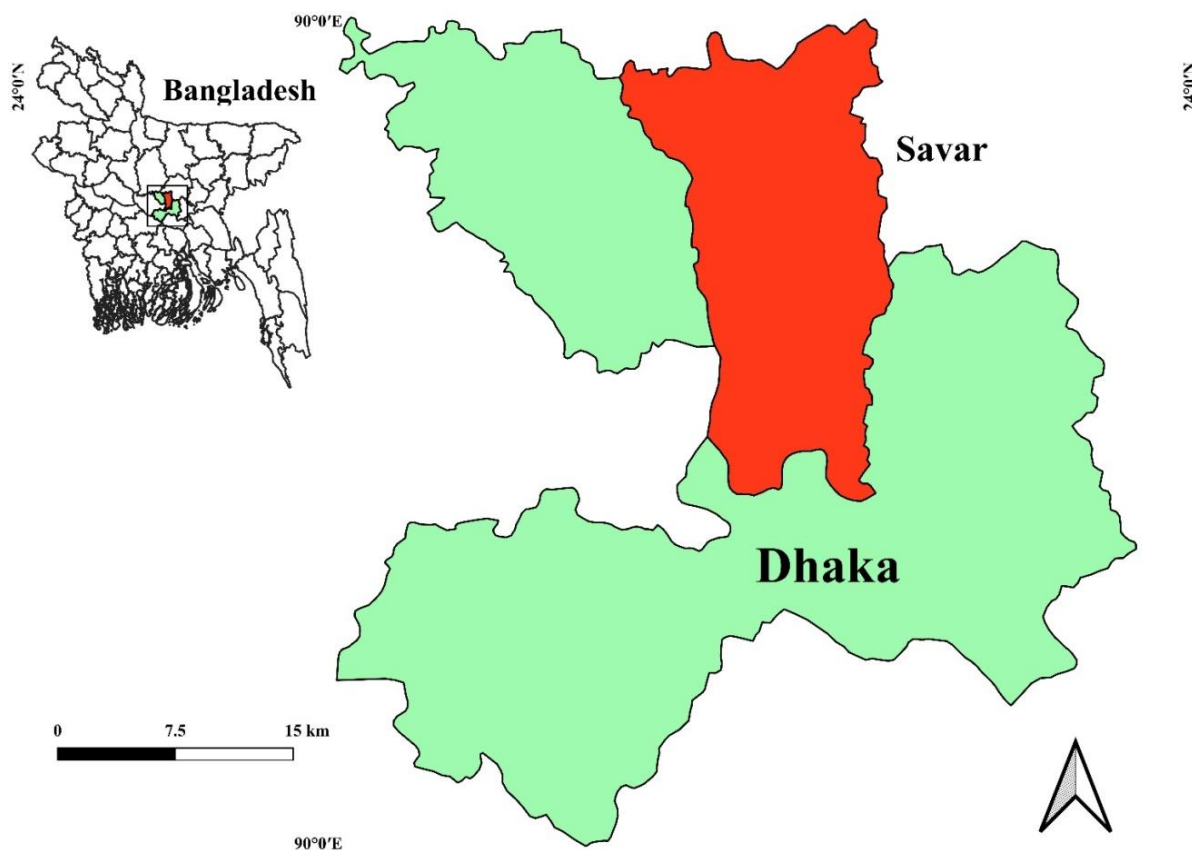


Figure 1. The study was conducted at the Upazila Livestock Office and Veterinary Hospital, and Supreme Pet Clinic, Savar, Dhaka, Bangladesh.

2.4. Observable clinical signs in feline panleukopenia in cats

The most common clinical indications of feline panleukopenia were vomiting (97.8%) and diarrhea (92.3%), of which 33.33% were bloody. Except for one cat, nearly all instances (98.9%) had anorexia in their feeding histories. Most of the affected cats (56%) had a normal temperature, followed by fever (31.9%) and subnormal temperature (12.1%), in that order. There were three categories for dehydration: normal, mild, and moderate. The highest percentage of cats (48.3%) had mild dehydration, which was followed by moderate (27.5%) and normal (24.2%) dehydration, respectively (Table 1).

Table 1. Observable clinical signs in feline panleukopenia-affected cats.

Clinical signs	Categories	Percentage (%)	
Diarrhea	Yes	84 (92.3)	Blood mixed: 28 (33.33) Absence of blood: 56 (66.66)
	No	7 (7.7)	
Vomiting	Yes	89 (97.8)	
	No	2 (2.2)	
Feeding history	Normal	1 (1.1)	
	Anorectic	90 (98.9)	
Temperature	Sub-normal	11 (12.1)	
	Normal	51 (56)	
	Fever	29 (31.9)	
Dehydration	Normal	22 (24.2)	
	Mild	44 (48.3)	
	Moderate	25 (27.5)	

2.5. Collection of samples and test procedure

The owner restrained pet cats for easy sampling. Rectal swabs were collected using a sterile cotton swab provided with a kit, kept in top-off extraction bottles containing assay buffer, and mixed properly. The

extraction bottles were then transferred to the laboratory instant and the test was done by TESTSEALABS FPV Ag Test Kit (Hangzhou, China) following the manufacturer's instructions (Figures 2, 3). The appearance of only one band (control band, C) within the result window indicated a negative result (Figure 2) while the appearance of two bands (test band, T, and control band, C) within the result window, no matter which band appeared first, indicated a positive result (Figure 3) (Hossen *et al.*, 2024).

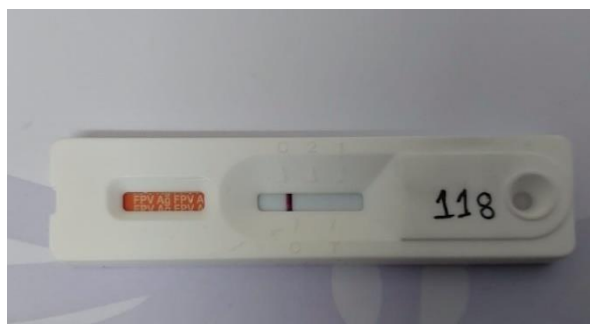


Figure 2. Negative result.

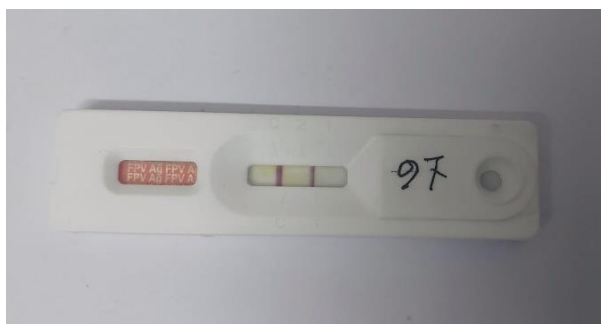


Figure 3. Positive result.

2.6. Line of treatment

As we know there is no specific treatment for viral disease. Medicine used for treatment was the antibiotic that belongs to third generation cephalosporin family (ceftriaxone) IM, anti-emetic drug (ondansetron) IV or IM, Metronidazole IV, IV fluid therapy, H2 blocker (pantoprazole or esomeprazole) IV, anti-inflammatory drug (meloxicam) SC, Hemostatic drug to control bloody diarrhea (tranexamic acid) IM, atropine sulfate IM to prevent excessive mucosal secretion and injected vitamins supplement to control intestinal erosion (Table 2).

Table 2. Line of treatment of feline panleukopenia affected cats.

Antibiotics/Antimicrobials	Ceftriaxone (C) Metronidazole (M) Combination of C and M
Fluid therapy	DNS 5% Normal Saline (NS) Cholera Saline (CS)
Proton pump inhibitor	Pantoprazole or Esomeprazole
Antiemetic	Ondansetron
Anti-inflammatory	Meloxicam
Hemostatic drug	Tranexamic acid
To prevent excessive mucosal secretion	Atropine Sulphate
Vitamins	Multivitamins or Vitamin B-complex

2.7. Data analysis

The data was collected from each patient and entered to the MS Excel (Microsoft Office Excel-2007, USA). Data management and descriptive analysis were performed in Excel.

3. Results and Discussion

3.1. Prevalence of Feline panleukopenia infection in cats in the study area

Among the 156 affected cats, 91 (58.33%) were infected with FPV (Table 3). According to this study, 58.33% of the cats in Bangladesh's Savar Upazila of Dhaka district have FPV. Compared to the findings from the present study, the prevalence of FPV was lower at 22.41% in Tangail and 40.45% in Barishal district, Bangladesh (Islam *et al.*, 2010; Hossen *et al.*, 2024). On the other hand, the prevalence of FPV infection was comparatively higher than the present study reported by a study at 79% in Iraq (Dishow *et al.*, 2024). Notably, samples from suspected domestic cats visiting veterinary institutions were deliberately gathered for our investigation. The prevalence may have been affected by this purposive sampling strategy, and it is possible that the results are not typical of Bangladesh's whole cat population.

Table 3. Seroprevalence, risk factors, and recovery rate of FPV infection in cats.

Variables	Categories	No. of the tested sample	Test results		Recovery rates (%)	
			Positive no.	Prevalence (%)		
Age	0 to 6 months	73	49	67.12	17	34.69
	7 to 12 months	49	29	59.18	19	65.52
	>12 months	34	13	38.24	06	46.15
Subtotal		156	91	58.33	42	46.15
Seasons	Summer	53	28	52.83	18	64.29
	Winter	66	45	68.18	15	33.33
	Rainy	37	18	48.65	09	50.00
Subtotal		156	91	58.33	42	46.15
Sex	Male	81	49	60.49	24	48.98
	Female	75	42	56.00	18	42.86
Subtotal		156	91	58.33	42	46.15
Immune status	Vaccinated	21	06	28.57	04	66.66
	Non-vaccinated	135	85	62.96	38	44.71
Subtotal		156	91	58.33	42	46.15

3.2. Effect of risk factors on the prevalence and recovery rate of FPV infection in cats

The infection was more prevalent in cats within 6 months of age (67.12%) compared with cats of age group 7 months to 12 months (59.18%) and age group > 12 months (38.24%). The cats showed higher recovery rate in the 7 to 12 months age group (65.52%) as compared with > 12 months (46.15%) and under 6 months (34.69%) against FPV infection (Table 3). Cats under 6 months of age had a higher prevalence and mortality of FPV and are essential in the transmission of the disease (Mosallanejad *et al.*, 2009; Islam *et al.*, 2010; Kim *et al.*, 2013). This might be due to lower immunity and vaccination rates in most kittens (Rehme *et al.*, 2022).

The present study showed that FPV infection in cats was more common in the winter (68.18%) than in the summer (52.83%) or during rainy (48.65%) seasons. The recovery rate of the disease was higher in the summer months (64.29%) than in the rainy season (50%) and winter months (33.33%) (Table 3). The results in this study partially corroborated the findings of Sultana *et al.* (2016) who conducted their investigation during the winter and found 20.2% FPV infection in cats. In addition, the FPV viruses are more likely to spread to cats in colder climates, and drier areas because they thrive over there. The virus can endure for several months due to its exceptional environmental conditions. In the winter season, the disease occurrence may be influenced by seasonal weight loss and reduced immunity (Naidenko *et al.*, 2014).

Male cats (60.49%) were more susceptible to FPV infection than females (56.00%). In addition, male cats (48.98%) responded to treatment more strongly than female cats (42.86%) (Table 3). Study also showed that male cats (59.5%) showed higher infection than females (40.5%) (Kruse *et al.*, 2010) which inclined the present study. It has been reported that estrogen has an immunostimulatory effect on the immune system whereas testosterone has an immunosuppressive effect. In females, increasing the expression of the homing marker CCR5 where estrogen controls T cell homing (Mo *et al.*, 2005).

In the present study, the non-vaccinated cats showed FPV positive (62.96%) than the vaccinated cats (28.57%) (Table 3) which supports the other study where non-vaccinated cats (37.1%) were also more infected than vaccinated cats (26.9%) (Chisty *et al.*, 2020). FPV-positive vaccinated cats have shown a better recovery percentage (66.66%) than non-vaccinated cats (44.71%) (Table 3). The vaccinated cat produces more protective immunity than non-vaccinated cats against FPV infection which decreases the susceptibility to infection (Rehme *et al.*, 2022).

4. Conclusions

Feline panleukopenia is a highly contagious and fatal disease of cats. The present study showed that young cats under six months of age are more infected than adults. The disease was comparatively more prevalent in winter than in summer and rainy seasons. Vaccinated cats were comparatively less infected than non-vaccinated ones. So, proper vaccination of cats before the winter season can reduce the severity of endemic infection. Further details on molecular epidemiology and preventive strategies need to be required to manage the feline panleukopenia virus infections in both domestic and stray cats in the study area.

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Data availability

The data presented in this study are contained in this manuscript.

Conflict of interest

None to declare.

Authors' contribution

Jabaer: investigation, data curation, writing - original draft; Md. Mamunur Rahman: investigation, writing - original draft; Md. Selim Ahmed: conceptualization, data curation, writing - review and editing the original draft. All authors have read and approved the final manuscript.

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