



Research Article

Prevalence of Feline Infectious Peritonitis in Pet Cats at Dhaka, Bangladesh: A Clinic-Based Cross-Sectional Study

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Abstract | Feline infectious peritonitis (FIP) is one of the most important fatal infectious diseases of cats and has a high mortality rate. The study finds out the prevalence of FIP in cats over Dhaka City Corporation. From October 2022 to December 2022, 479 cats were investigated at the Care and Cure Veterinary Clinic in Dhaka. The study showed that approximately 3% (15/479) of cats had feline infectious peritonitis base on clinical history, clinical examination, FIP antibody kit test, blood test and Rivalta's test. The prevalence of young cats was 6.94%, sexually intact cats 5.29% and 20% of cats in poor health conditions were significantly associated with the occurrence of FIP ($p \leq 0.05$). Sex and breed were not statistically associated with FIP but had a comparatively high prevalence. Most of the suspected FIP clinical feature was effusive (66.66%). This outcome provides an empirical analysis of FIP in the city of Dhaka. The results demonstrate an unambiguous correlation between age and neutering status. This finding will contribute to develop future investigations.

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Introduction

The human-animal interaction between people and their pets has evolved and developed over time. Bangladeshis are spending more money on their pets nowadays, which is fueling the local pet industry. Many diseases affect pets in the city of Dhaka, yet pet owners are unaware of these illnesses, their treatment options, and their immunization schedules (Husna et al., 2016). However, there had very few studies on feline infectious peritonitis in pet cats. Feline

infectious peritonitis (FIP) is a deadly viral-induced, immune-mediated disease that affects domesticated cats and certain wild felids worldwide (Lloret, 2009). The contagious disease feline Infectious peritonitis virus (FIPV), a virulence biotype of the feline enteric coronavirus (FECV), has been conclusively demonstrated to belong to the genus Alphacoronavirus and family Coronaviridae (Pedersen et al., 1981). FIP is caused by the feline infectious peritonitis virus (FIPV), a mutant form of the feline coronavirus (FCoV) (Bank-Wolf et al., 2014). There is a wide

range of FCoV infection symptoms. Except from a mild enteritis, the majority of FCoV-infected cats appear healthy. Feline infectious peritonitis (FIP), a fatal variant of the infection, can occur in up to 12% of cats with FCoV infection (Lloret, 2009; Pedersen *et al.*, 2009). Even though there is a significant prevalence of FCoV infection, only about 5% of cats in multiple-cat households and considerably less in environments with just one cat go on to develop FIP (Pedersen, 1976; Addie and Jarrett, 1992).

This disease is associated with a high death rate, which is especially true in younger cats confined in breeding catteries and animal shelters (Pedersen, 2014). Infection rates for FCoV in cats are commonly approximately 1%, although they might vary based on factors like age, breed, environment, and superinfection with other viruses (Foley and Pedersen, 1996; Hartmann, 2005; Pedersen, 1976; Sparkes *et al.*, 1992). Around 5-10% of seropositive cats may show signs and eventually die from FIP (Addie and Jarrett, 2006).

Ingestion and potentially inhalation of virus particles in feces are thought to be the primary routes of FIPV infection. FIPV particles may be transferred by saliva, respiratory secretions, and urine in early infections (Herrewegh *et al.*, 1995). FIP is classified as either wet (effusive) or dry (non-effusive) based on its clinical appearance. The wet variant is distinguished by immune-mediated fibrinous-granulomatous serositis, which is frequently accompanied by protein-rich effusions in the thoracic or abdominal cavities (Lloret, 2009a). The dry form of the illness, on the other hand, is distinguished by granulomatous involvement of parenchymatous organs such as the kidneys, mesenteric lymph nodes, intestinal wall, liver, central nervous system, and eyes (Montali and Strandberg, 1972). Cats rarely demonstrate both kinds of the condition at the same time, and when they do, it is generally a stage of transition from wet to dry or dry to wet. Despite the fact that some cats with FIP can survive for weeks, months, or even years (Pedersen, 2014), the average survival period for effusive FIP is between days and weeks, whereas non-effusive FIP typically lasts between weeks and months (Fischer *et al.*, 2011; Hugo and Heading, 2015).

Due to the difficulties in making a conclusive diagnosis and identifying appropriate therapies, this condition continues to be a troublesome and

elusive issue for veterinarians and cat breeders (Kipar and Meli, 2014). Although effusions, tissue, and serum antibody tests using reverse transcriptase polymerase chain reaction (RT-PCR) have been thought to be useful in supporting a clinical diagnosis of FIP (Pedersen, *et al.*, 1984), they must always be considered in conjunction with the patient's history and other clinicopathological findings and can never be used alone (Addie *et al.*, 2004).

In hospitals, rapid kit tests for FIP are widely utilized. The FIP antigen rapid test device is a lateral flow immunochromatographic technology for the qualitative identification of FIP viral antigens in feline feces or ascites. This test's sensitivity and specificity are 84.6% and 100%, respectively (FASTest FIP) (Addie *et al.*, 2015).

However, there are currently no reliable ways to stop or treat FIP infection. Over the world, the prevalence of FCoV infections may reach 90% in environments with many cats and 10% to 60% in domestic cats (Bell *et al.*, 2006; Herrewegh *et al.*, 1997; Lloret, 2009a; Pedersen *et al.*, 2004; Sharif *et al.*, 2009; Taharaguchi *et al.*, 2012). There has not yet been research publication on FIP prevalence in Bangladesh. Since there have been few studies on feline infectious peritonitis in Bangladesh. The current study was conducted to assess the prevalence and the risk factors associated with feline infectious peritonitis of pet cats in Dhaka city.

Materials and Methods

Study area and study duration

From October 2022 to December 2022, a study was conducted at Care and Cure Veterinary Clinic to evaluate the prevalence of feline infectious peritonitis (FIP) in cats in Dhaka City Corporation, Bangladesh as shown in Figure 1. FIP infected cats of various ages, sexes, neutering and breeds were taken into the study. During the study period, 479 cats were examined in the clinics of these, 15 cats of different breeds suffered feline infectious peritonitis. All of the studied cats reported a history of lethargy, anorexia, weight loss, Ascites, persistent fever, jaundice and neurological issues.

Diagnosis of disease

The disease was identified based on basic information collection, clinical history, clinical examination, blood

tests, Rivalta's test, and FIP antibody kit test. Clinical history was collected by the owner with the help of a performed questionnaire. The infected cats had lethargy, anorexia, weight loss, ascites, recurrent fever, neurological problems and jaundice (Figure 3). Whenever a cat first showed signs of feline infectious peritonitis, a rapid antibody kit test, a Rivalta's test, and a blood test were used for confirmation (Figure 2). Both a blood test and a Rivalta's test were used to identify the type of FIP infection in cats. Results from the Rivalta's test indicated effusion FIP.

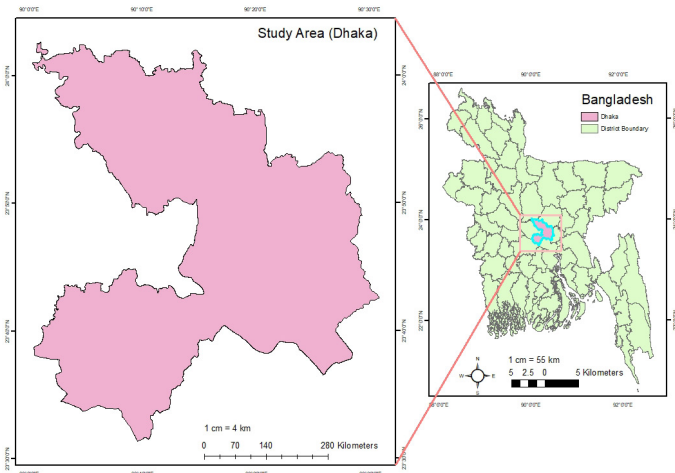


Figure 1: The study area location map of Dhaka, Bangladesh. The image was created using ArcGIS 10.8 (ArcGIS Enterprise, ESRI, California, USA).

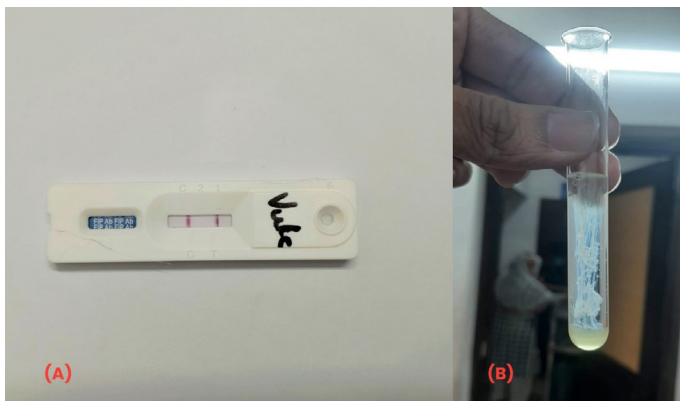


Figure 2: Feline Infectious Peritonitis positive case in kit test (A) and Rivalta's test (B).

FIP antibody kit test: A swab was inserted into the anus of the suspicious cats and samples were collected in a diluent tube. The sample was then mixed and a few drops of the mixture were used for the rapid antibody test. If the control band (C) and test band (T) both appeared within 5-8 minutes, then the test was positive for FIP virus antibodies.

Blood test: If there is a clinical suspicion that a cat has FIP infection, the blood test should be conducted.

Additionally, a complete blood count and serum chemistry profile must be done. A serum albumin-to-globulin ratio of less than 0.8 has a 92% positive predictive value that the cat has a chance of FIP, whereas a ratio greater than 0.8 has a 61% negative predictive value that the cat does not have FIP. It was noted that an albumin-to-globulin ratio of at least 0.8 was reported to be acceptable (Hartmann *et al.*, 2003).

Rivalta's test: The Rivalta's test is done if there is a possibility of FIP infection with ascites. To perform the test, acetic acid and distilled water are mixed in a tube and a drop of the effusion fluid is carefully added. A positive result is indicated when the drop remains intact, connected to the surface, or slowly descends down the tube (drop- or jellyfish-like). If the drop is disappeared, but the solution remains clear, or if there are cloudy or clear pieces falling, the test is negative (Fischer *et al.*, 2013).

Data analysis

All of the data was imported into Microsoft Office Excel 2016 and analyzed with SPSS version 23. According to age, sex, breed, neutering, and health status, the data were reported as prevalence percentages. To determine the disease's prevalence, descriptive statistics were used, and the chi-square (χ) test was applied to establish the significance of any differences found within the categories investigated. Using a chi-square test, the p-value was calculated with a 5% level of significance.

Results and Discussion

The investigation was conducted during the fourth quarter of the year and a total of 479 cats were examined for clinical signs of feline infectious peritonitis (FIP). It was found that 15 cats tested positive for the FIP, with age, sex, neutering, and breeds being amongst the risk factors. The prevalence of FIP at Care and Cure Veterinary Clinic in Dhaka was calculated to be 3.13%, with 15 cases detected out of the total 479 examined. However, the current study, which is aligned with other prior studies in China (0.61%) (Yin *et al.*, 2021a), Germany (1.42%) (Riemer *et al.*, 2016) and Austria (8.78%) (Benetka *et al.*, 2004). However, earlier research revealed that the prevalence of FIP was 0.02 percent in households with one or two cats, and between 5% to 10% in catteries (Pedersen, 1976; Addie and Jarrett, 1992).

Table 1: Prevalence of feline infectious peritonitis according to different Risk Factor at Dhaka city.

Variables	Categories	No of observation	Positive case	Prevalence (%)	Chi-square tests	P-value
Age	0-10 month	144	10	6.94	9.3527	0.024951*
	11-20 month	151	3	1.99		
	21-30 month	116	1	0.86		
	>31 month	68	1	1.47		
Sex	Male	245	9	3.67	0.4562	0.499398
	Female	234	6	2.56		
Breed	Local	178	6	3.37	4.3457	0.36124
	Persian	141	3	2.13		
	Mixed	142	5	3.52		
	British Short Hair	11	1	9.09		
	Bengal	6	1	16.67		
Neutering	Intact	210	11	5.24	5.1169	0.023694*
	Neutered/Spayed	269	4	1.49		
Health Status	Good	360	2	0.56	33.0222	< 0.00001*
	Moderate	99	9	9.09		
	Poor	20	4	20		

Table 1 shows the prevalence of feline infectious peritonitis in a variety of age groups. Maximum FIP prevalence was 6.94% found in the age group of 0-10 months, compared to 1.99%, 0.86%, and 1.47% in the age groups of 11-20 months, 21-30 months, and >31 months respectively. Based on statistical analysis, FIP prevalence was considerably higher in certain age groups ($P=0.024951$, $\chi^2=9.3527$). In contrast to young cats, older cats were significantly ($P<0.05$) less common. Disease was significantly associated with age and more likely to attack kitten cats (0-10 months). According to earlier studies (Riemer *et al.*, 2016; Soma *et al.*, 2013; Yin *et al.*, 2021b), this study clearly suggests that young cats were most frequently affected by FIP. 70% of cases are under a year old, considering age a major risk factor (Rohrer *et al.*, 1993; Hartmann, 2005).

By gender, male cats (3.67%) have a higher prevalence than female cats (2.56%). There was no significant correlation between FIP and sex ($P=0.499398$, $\chi^2=0.4562$). While it was true that male cats had a higher prevalence of FIP than female cats, the difference in prevalence was not statistically significant ($P>0.05$). In the current investigation, we did not see any gender bias. This finding is similar to (Yin *et al.*, 2021b) observation. Several research have identified gender as a risk factor for FIP, particularly in intact males (Norris *et al.*, 2005; Pesteanu-Somogyi *et al.*, 2006; Rohrbach *et al.*, 2001). Though, a few research

(Benetka *et al.*, 2004; Riemer *et al.*, 2016; Worthing *et al.*, 2012) showed that males had significations relationships.



Figure 3: Cat affected with feline infectious peritonitis (FIP) at Care and Cure Veterinary Clinic in Dhaka.

According to various breeds, the prevalence rates for the local, Persian, mixed, British short hair, and Bengal were 3.37%, 2.13%, 3.52%, 9.09%, and 16.67%, respectively. With 16.67%, the Bengal cat had the highest prevalence. There was no association ($P=0.36124$, $\chi^2=4.3457$) between breed and FIP infection. The prevalence of FIP in different breeds was statistically insignificant ($P>0.05$). The current study reveals that no evidence of breed has a relationship with FIP. FIP can grow to any breed of cat. Regarding

the breeds, there were no significant differences. This was in agreement with previous surveys (Almeida *et al.*, 2019; Riemer *et al.*, 2016; Yin *et al.*, 2021b). However, the prevalence of FIP detection was significantly higher in pure bred cats (Pesteanu-Somogyi *et al.*, 2006b). Although random breeding cats are known to have less linkage disequilibrium than pedigreed cats, the current investigation was conducted on these animals (Alhaddad *et al.*, 2013).

The current study reveals that neutering has a significant association ($P=0.023694$, $\chi^2=5.1169$) with FIP. The proportion of sexually intact cats (5.24%) was significantly ($P<0.05$) higher compared to neutered/spayed cats (1.49%). These findings are consistent with earlier study's data on the occurrence of FIP (Yin *et al.*, 2021b; Rohrbach *et al.*, 2001). Cats in poor health (20%) are more susceptible to FIP than those in normal health (0.56%). For various health status, FIP in cats differed significantly ($P<0.00001$, $\chi^2=33.0222$). Although no relevant study was identified to explain the cause of this relation, it is worth mentioning that cats in poor health are more likely to get diseases. Out of the 15 cats in which FIP was highly suspected, with effusive FIP representing to 10 of cases and non-effusive FIP for 5 cases (Table 2). According to recent investigations, effusive (66.67%) and non-effusive (33.33%) clinical features were present in the vast majority of FIP patients. This finding is consistent with (Yin *et al.*, 2021), which revealed that 85.8% of cats presented with effusive FIP.

Table 2: Distribution of clinical feature of effusive and non-effusive cats with FIP.

FIP clinical feature	Suspected FIP	Number of cats with clinical signs	%
Effusive /Wet	15	10	66.67
Non-effusive/Dry	15	5	33.33

Conclusions and Recommendations

The current study explored the prevalence and identify the factors associated with FIP in the largest private veterinary clinic in Dhaka, Bangladesh. The overall prevalence of FIP was found to be 3.13 % in the current study. Cats of the various breeds and sexes examined don't seem to pose a higher danger although having a strong correlation with age, neutering, and health status. It was revealed that young and sexually intact cats were susceptible for FIP. The most

common clinical sign was effusive FIP. Unfortunately, there are no effective vaccines or treatments available in Bangladesh. The study had several limitations. However, more studies with bigger sample sizes are essential to accurately figure out the epidemiological pattern of FIP in Bangladesh.

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Novelty Statement

The author is aware of no thorough study that evaluated the clinical prevalence of FIP in Bangladesh and there are no published statistics in this regard. It was the first study of hospital-based prevalence ever conducted. This finding will contribute to the development of future research.

Author's Contribution

Tajul Islam Mamun collected, conceived and designed the experiments, analyzed and interpreted the data, wrote the paper. Jillur Rahman, Jamal Hossain, Mahmudul Hasan, Md Wakil Mahmud and Kamruz Zaman performed the experiment and interpreted the data; Wrote the paper. All authors reviewed and approved the final paper.

Conflict of interest

The authors have declared no conflict of interest.

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