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Original Research

Prevalence and risk factors of Feline Infectious Peritonitis of cat in Dhaka, Bangladesh: A cross-sectional study

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Abstract

Feline Infectious Peritonitis (FIP), caused by Feline Coronavirus (FCoV), is a fatal disease affecting domestic and feral cats worldwide. This study aimed to determine the prevalence, risk factors, and clinical manifestations of FIP and to analyse treatment protocols employed at the Central Veterinary Hospital (CVH), Dhaka, Bangladesh. A total of 305 feline cases were examined during a five-month period (December 2023–May 2024), revealing an FIP prevalence rate of 12.13%. Key risk factors included age, sex, breed, and vaccination status. Cats aged 11–20 months and >31 months, males, non-vaccinated, and certain breeds such as British Shorthair and Bengal cats demonstrated higher susceptibility. Clinical manifestations predominantly included ascites (100%) and respiratory distress (81.09%), with fever (67.56%) and mild dehydration (86.48%) also observed. The effusive form of FIP was more prevalent, characterized by fluid accumulation in body cavities. Diagnostic confirmation utilized rapid diagnostic test kits and Rivalta's test, with a combination of both tests achieving the highest accuracy. This study underscores the critical need for early diagnosis, vaccination programs, and breed-specific prevention strategies to reduce the impact of FIP. Enhanced diagnostic tools. These findings provide valuable insights into the clinical management of FIP in the feline population in Dhaka, contributing to global efforts in understanding and mitigating this devastating disease.

1. Introduction

Coronaviruses belong to a large family of viruses that capable of infecting wide range of host causing Covid-19 in human, Feline Infectious Peritonitis in cat, Gastroenteritis in dog and Infectious Bronchitis in chicken (Gozalo *et al.*, 2023; Domańska-Blicharz *et al.*, 2020). Coronaviruses have a substantial ability to mutate, which complicates the treatment of infected hosts (Sharif *et al.*, 2010). The virus belongs to the family Coronaviridae of Genus Alphacoronavirus. The virion structure is pleomorphic spherical and it consists of positive-sense, single stranded enveloped RNA with the genome size of approximately 30kb of non-segmented gene (Zhou *et al.*, 2021; Sifa-Shaida *et al.*, 2020; Arshad *et al.*, 2004). Feline infectious peritonitis (FIP) is caused by Feline Coronavirus (FCoV), a highly fatal disease affecting both domestic and feral cats (Stout *et al.*, 2022). FCoV is divided into two biotypes which includes feline enteric coronavirus (FECV) and feline infectious peritonitis virus (FIPV) (Solikhah *et al.*, 2024; Licitra *et al.*, 2013). Development of a human-animal relationship depends on individuals. The pet sector is growing of increased expenditure by Bangladeshis on their animals (Arefin *et al.*, 2024). Many pet owners in Dhaka remain unaware of the illness, treatment options, and vaccination schedules for their pets

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(Rana *et al.*, 2021). However, there had very few studies on feline infectious peritonitis in pet cats. The FIP is a deadly viral-induced, immune-mediated disease that affects domesticated cats and certain wild felids worldwide (Hu *et al.*, 2024). Except from a mild enteritis, the majority of FCoV-infected cats appear healthy. The FIP, a fatal variant of the infection, can occur in up to 12% of cats with FCoV infection (Tasker *et al.*, 2023; 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 (Gao *et al.*, 2023; Pedersen, 2009). Doherty was the first researcher to describe the ocular manifestations of FIP. There are just three descriptions of dermatological lesions in conjunction with spontaneous FIP in the body of veterinary literature (Declercq *et al.*, 2008; Gross, 1999).

This indicates that these conditions are quite uncommon. Clinical lesions that have been reported in the past include truncal papules to nodules that are characterized by pyogranulomatous vasculitis and folliculitis, small nodules over the neck and proximal forelimbs that are characterized by pyogranulomatous phlebitis in a cat that has concurrent FCoV infection (Backel and Cain, 2017), and papular lesions over (Gross, 1999). It is difficult to diagnose FIP, and in most situations, an antemortem diagnosis of FIP may be tough as well, particularly in cases that are non-effusive and 'dry' (Pedersen, 2009). Histopathologic evaluation of biopsy or necropsy samples is regarded to be the gold standard test. In addition, immunohistochemistry (IHC), which involves the identification of intracellular FCoV antigens in macrophages, is often necessary to confirm the illness (Addie *et al.*, 2022; Giori *et al.*, 2011; Hartmann, 2005; Pedersen, 2009). The

condition known as feline infectious peritonitis is often misdiagnosed. It is not uncommon for its vague general clinical symptoms to be present. Some examples of these symptoms are prolonged fever, weight loss, anorexia, and malaise. Some examples of clinicopathologic abnormalities in FIP that do not serve as pathognomonic indicators include lymphopenia, neutrophilia, anemia, hyperproteinemia, and hypergammaglobulinemia (Felten and Hartmann, 2019; Scherk *et al.*, 2013).

The FCoV poses a significant health challenge to domestic and feral cats globally (Tasker *et al.*, 2023), yet the understanding of its prevalence, risk factors, and clinical manifestations remains limited in many regions, including Bangladesh. Most studies on FIP have been conducted in developed countries, where veterinary resources and diagnostic capabilities differ significantly from those available in developing nations. Additionally, the role of demographic, environmental, and genetic factors influencing the susceptibility and progression of FIP in local cat populations remains underexplored. In Bangladesh, there is a lack of comprehensive research on FIP, specifically regarding its prevalence, associated risk factors, and clinical presentation. This gap hampers efforts to design effective prevention strategies, improve diagnostic accuracy, and establish optimal treatment protocols tailored to the regional feline population.

Many diseases affect pets in Dhaka, but many pet owners are unaware of these illnesses, their treatment options, and their immunization schedules (Mamun *et al.*, 2023). The objectives of this study are to determine the prevalence of FIP among pet cats treated at the Central Veterinary Hospital (CVH) in Dhaka, Bangladesh, and to identify key risk factors such as age, sex, breed, neutering status, and vaccination status that contribute to the development of the disease. Additionally, the study aims to describe the clinical manifestations of FIP, with a focus on distinguishing between effusive and non-effusive forms. Ultimately, the study strives to provide evidence-based recommendations for improving early diagnosis, implementing effective vaccination programs, and designing targeted prevention strategies to reduce the prevalence and impact of FIP in the local feline population.

2. Materials and Methods

2.1 Ethical approval

No ethical approval is required for this study.

2.2 Study area and periods

The study was conducted in Dhaka, Bangladesh (Figure 1). Total 305 cases data are collected from December, 2023 to May, 2024.

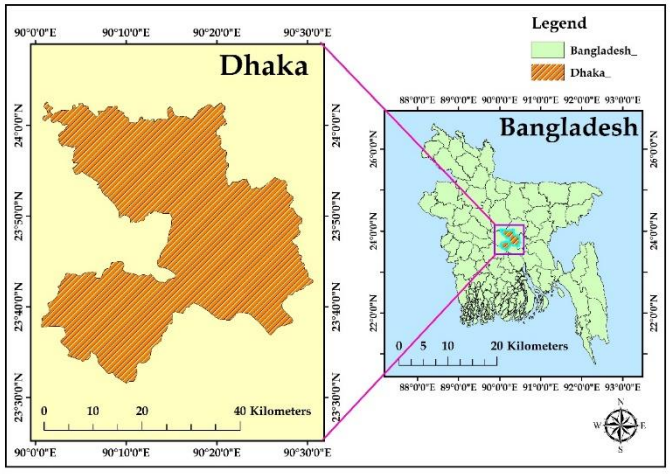

Figure 1. Geographical location of study area.

2.3 Data collection

A total of 305 feline cases presented at CVH were examined. Detailed epidemiological data were collected using a structured questionnaire. The data collected encompassed owner information, including address and demographic details, as well as comprehensive animal information such as age, sex, breed, vaccination status, neutering/spaying status, health status, body weight, duration of illness, and clinical signs like defecation, vomiting, and anorexia. Additionally, health data, including body weight and other clinical signs, were also recorded. Physical examinations recorded pulse, respiration, and rectal temperature. Information about treatment protocols, including the main and supportive drugs administered and their frequency, was documented.

2.4 Diagnostic approach

FIP was tentatively diagnosed based on clinical signs such as weakness, depression, anorexia, abdominal distension, and respiratory distress. Confirmatory diagnoses utilized rapid diagnostic kits and Rivalta's test (Figure 2). For the rapid diagnostic test, fluid or fecal samples were collected, and the manufacturer's protocol was followed, with positive results indicated by two lines on the test cassette. Rivalta's test involved mixing a drop of fecal or abdominal fluid with 5–10 mL of distilled water and 1 drop of 98% acetic acid. A positive result was indicated by the fluid drop remaining intact or sinking like a jellyfish (Figure 3).

To enhance the accuracy of FIP diagnosis, this study utilized a combined diagnostic approach involving the Rivalta's test and a rapid antigen kit test. These methods complement each other by addressing their respective limitations. The Rivalta's test, though highly sensitive for detecting effusions consistent with FIP, may yield false positives in other inflammatory conditions. In contrast, the rapid antigen kit test is highly specific for detecting FCoV antigens but may result in false negatives in cases with low antigen levels, particularly in dry and mixed forms of FIP. By integrating these methods, the study aimed to maximize diagnostic sensitivity and specificity, ensuring accurate differentiation of FIP from other conditions. The Rivalta's test was used as a sensitive initial screening tool, while the rapid antigen kit test provided specific confirmation of FCoV infection in effusion samples flagged by the Rivalta's test.

Figure 2. The test line showed positive result in rapid FIPV Ab test kit.

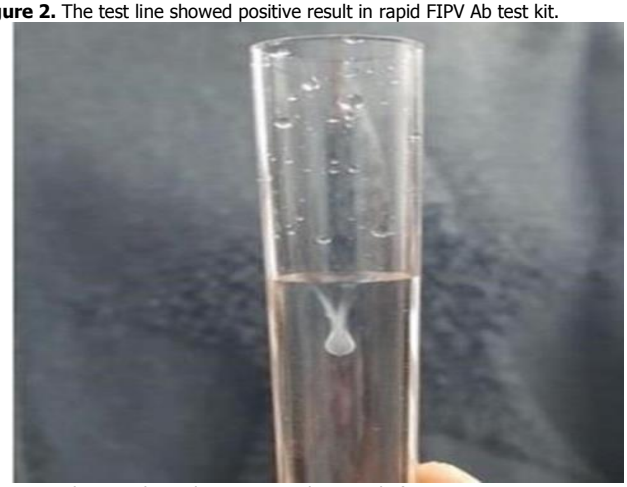

Figure 3. The test showed positive result in Rivalta's test.

2.5 Statistical analysis

Statistical analysis of prevalence data was conducted using the Statistical Package for Social Science (SPSS.v.25, IBM, Chicago, IL, USA) software to determine potential risk factors after the data from this study were integrated using Excel 365 (Microsoft/Office 365, Redmond, WA, USA).

3. Results

3.1 Prevalence of diseases at CVH

The prevalence of various diseases among feline cases at the Central Veterinary Hospital (CVH) was analyzed. Feline Panleukopenia Virus (FPV) was the most prevalent condition, affecting 23.6% of the population. Feline Infectious Peritonitis (FIP) ranked second, with a prevalence rate of 12.13%. Other conditions included accidental injuries (11.47%), parasitic infestations (9.5%), fungal infections (8.19%), and conjunctivitis (7.54%). Gastritis, nutritional deficiencies, pneumonia, dog bite injuries, and food poisoning were less common, with rates ranging from 6.89% to 3.93% (Figure 4). This distribution highlights FIP as a critical health concern.

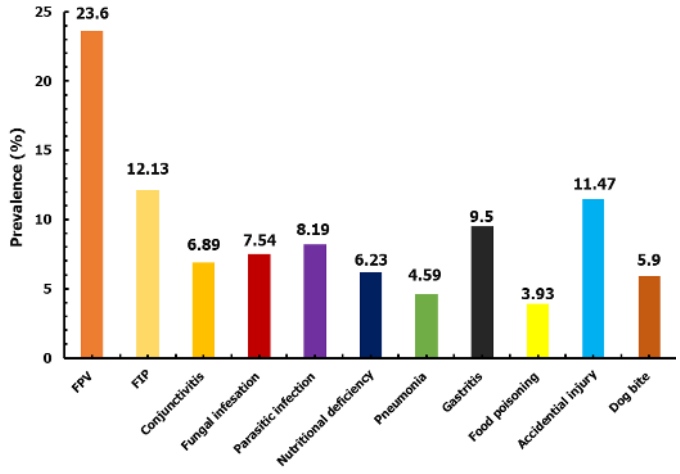

Figure 4. Prevalence of different diseases at CVH.

3.2 Frequency of observation of clinical sign associated with FIP

Three time periods are assigned to this variable: 2–7 days, 8–28 days, and more than 29 days. Most of the cats (62.16%) only had symptoms for a brief period of time, ranging from two to seven days, suggesting that a considerable proportion of cases advance rapidly. A lower percentage (16.21%) of cases experienced symptoms for more than 29 days, indicating the variation in the disease's course. 21.62% of cases had an intermediate length of 8–28 days. Fever was the most common temperature-related symptom, appearing in 67.56% of patients, indicating that fever is a common indicator of FIP. A normal temperature was detected in 18.91% of the cats, demonstrating that not all FIP-positive animals are feverish. Hypothermia, or abnormally low body temperature, was detected in 13.51% of cases, indicating a less common but significant symptom. Dyspnea, defined as laborious or difficult breathing, was seen in 81.09% of cases, making it one of the most common clinical symptoms in FIP-positive cats. This respiratory discomfort could be linked to fluid accumulation in the bodily cavities, which impairs lung function. Mild dehydration was seen in the vast majority of the cats (86.48%), which is a common occurrence due to decreased water intake or loss through vomiting or diarrhea. Moderate dehydration was less common, occurring in 13.51% of cases, but nonetheless considerable given the disease's overall influence on fluid balance. Ascites or fluid collection in the abdominal cavity, was found in all 37 instances (100%). This observation is typical of the effusive (wet) form of FIP, in which the accumulation of fluid causes abdominal bloating and discomfort (Table 1).

Table 1. Frequency distribution of observable clinical signs of FIP at CVH in Dhaka.

Variable	Categories	Total number of cases	Frequency	Prevalence (%)	95% Confidence Interval	*P*-value
Duration of illness	2-7 days	37	23	62. 16	46.10-75.93	0.18
	8-28 days	37	8	21.62	11.38-62.80	0.00
	>29 days	37	6	16.21	7.65-31.13	4.12
Temperature	Fever	37	25	67.56	19.63-48.53	0.04
	Normal	37	7	18.91	9.47-34.20	0.00
	Hypothermia	37	5	13.51	5.91-27.97	7.42
Respiration	Dyspnea	37	30	81.09	65.79-90.52	0.00
Dehydration	Mild	37	32	86.48	72.02-94.08	7.42
	Moderate	37	5	13.51	5.91-27.97	7.42
Ascites	Fluid accumulation into body cavity	37	37	100.00	90.59-100	1.45

3.3 Frequency distribution of tests for FIP-positive cats at CVH

The effectiveness of different diagnostic methods for Feline Infectious Peritonitis (FIP) was analyzed among the positive cases at the Central Veterinary Hospital (CVH). Three diagnostic approaches were employed: Rapid Diagnostic Kits, Rivalta's test, and a combination of both. Rapid Diagnostic Kits identified 35.13% of the positive cases, demonstrating their utility as a quick and accessible diagnostic tool. Rivalta's Test, a traditional confirmatory method, accounted for 13.51% of positive diagnoses, indicating its supplementary role in diagnosis. Combination of Both Tests yielded the highest accuracy, diagnosing 51.35% of the positive cases. This emphasizes the advantage of integrating multiple diagnostic approaches to enhance reliability and reduce false-negative results (Figure 5). The distribution of these results underscores the importance of employing a combination of diagnostic methods to confirm FIP, given the complexities and overlapping symptoms of the disease. The integration of Rapid Diagnostic Kits and Rivalta's test provides a robust framework for accurate diagnosis in clinical settings.

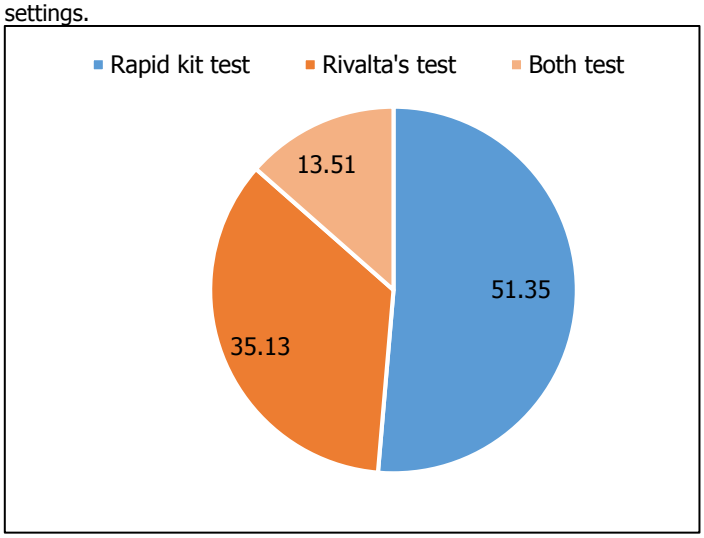

Figure 5. Frequency distribution of test for FIP positive cat at CVH.

3.4 Risk factors associated with FIP

FIP prevalence was influenced by multiple risk factors. The highest prevalence was observed in cats aged 11–20 months (10.42%) and >31 months (10.15%), with lower prevalence in younger cats (0–10 months, 5.17%). Male cats had a slightly higher prevalence (15.17%) compared to females (12.00%). Breed-specific analysis revealed that British Shorthair cats had the highest prevalence (27.28%), followed by Bengal cats (20.00%). Local and mixed-breed cats showed lower prevalence rates of 7.75% and 4.28%, respectively. Non-vaccinated cats exhibited significantly higher prevalence (78.37%) compared to vaccinated cats (21.62%). Additionally, intact cats showed a higher prevalence (9.52%) compared to neutered/spayed cats (6.29%) (Table 2).

Table 2. Prevalence of risk factors associated with FIP in Dhaka.

Variable	Category	Number of observation	Positive case	Prevalence (%)	95% Confidence Interval	P-value
Age	**0-10 Month**	116	6	5.17	2.61-11.80	7.54
	11-20 Month	144	15	10.42	6.41-16.47	2.35
	21-30 Month	151	9	5.96	3.16-10.93	6.59
	>31 Month	69	7	10.15	5.00-19.49	4.10
Sex	**Male**	145	22	15.17	10.23-21.90	3.20
	Female	125	15	12.00	7.40-18.85	4.91
Breed	**Local**	142	11	7.75	4.38-13.33	3.11
	Persian	178	12	6.74	3.89-11.41	8.12
	Mixed	140	6	4.28	1.97-9.03	1.40
	Bengal	25	5	20.00	8.86-39.13	0.00
	British short hair	11	3	27.28	9.7-56.56	0.22
Neutering /Spaying	**Intact**	210	20	9.52	6.24-14.25	6.09
	Neutered/sp ayed	270	17	6.29	3.96-9.85	4.08
Health status	**Good**	280	18	6.43	4.10-9.93	1.10
	Moderate	160	13	8.12	4.80-13.40	6.57
	Poor	80	6	7.5	3.48-15.41	5.39
Vaccination status	**Vaccinated**	37	8	21.62	11.38-37.19	0.00
	Non vaccinated	37	29	78.37	62.80-88.61	0.00

4. Discussion

The prevalence of FIP in the cat population at the CVH, Dhaka, as identified in this study, aligns with previous research indicating the significance of FIP as a serious health concern for felines worldwide. The overall prevalence of FIP in the studied population was 12.13%, which is comparable to global reports where FIP prevalence in cat's ranges from 5-12% in multi-cat households (Pedersen *et al.*, 2009).

The study confirms that while many cats are infected with FCoV, only a small percentage develop FIP. One notable aspect of the study was the significant risk factors such as age and breed predisposition and he role of neutering and vaccination status.

Cats over 30 months and those under 10 months were found to be more susceptible, highlighting the need for targeted prevention strategies for younger and older cats. The observation that male cats had a slightly higher prevalence of FIP compared to females (15.17% vs. 12%) aligns with the findings of Pedersen (2009), who suggested that male cats might have an increased predisposition to the disease. Additionally, certain breeds, particularly the Bengal and British Shorthair, showed higher susceptibility, suggesting that genetic factors may play a role in FIP vulnerability. These findings are consistent with previous studies that highlight breed predisposition as a factor in FIP development (Addie *et al.*, 2020).

The clinical presentation of FIP observed in this study mirrors the classic signs reported in other studies. Ascites, present in all FIP-positive cases (100%), is a hallmark of the effusive or 'wet' form of the disease, further validating its utility as a key diagnostic indicator. The prevalence of respiratory distress (dyspnea), observed in 81.09% of the cases, underscores the systemic nature of the disease, as respiratory symptoms often result from fluid accumulation in body cavities. This aligns with earlier research that documents the multisystem involvement of FIP, particularly in its effusive form (Hartmann, 2005). The high mortality rate associated with FIP, coupled with the challenges in early diagnosis, particularly for the dry form, highlights the need for improved diagnostic tools. While rapid diagnostic kits are available, this study showed that 51.35% of cases required both the Rivalta's and Rapid Kit tests for confirmation, indicating that no single test may be fully reliable. Thus, a combination of tests, along with clinical evaluation, remains essential for accurate diagnosis.

This study adds to the growing body of literature on FIP, providing valuable insights into its prevalence and clinical management in a hospital setting in Dhaka, Bangladesh. The findings emphasize the importance of early diagnosis, vaccination, and breed-specific prevention strategies in mitigating the spread and impact of this devastating disease. Future research should focus on improving diagnostic techniques and exploring more effective antiviral treatments to better manage FIP in cats. This discussion is tailored to reflect my findings and the current scientific understanding of FIP.

5. Conclusions

The study highlights the significant prevalence of Feline Infectious Peritonitis (FIP) among cats at Central Veterinary Hospital in Dhaka, Bangladesh. The findings underscore FIP as a critical health issue with a prevalence of 12.13%, aligning with global statistics. Several risk factor such ages, sex, breed and vaccination status were identified, emphasizing the need for targeted prevention strategies, particularly for vulnerable groups such as young, old and unvaccinated cats. Clinical manifestations like ascites and respiratory distress were prevalent, with diagnostic challenges remaining especially in non-effusive cases. Although antiviral treatment such as remdesivir offer some hope, the high prevalence of FIP in treated cat calls for further research into more effective therapeutic options. Early detection and vaccination remain crucial strategies to mitigate FIP's impact on Bangladesh's cat population. This study adds valuable knowledge to FIP's clinical management and emphasizes the importance of early diagnosis, use improved diagnosis methods, effective vaccination strategies, and continuous research into improved treatment as well as a wider geographic area enhance the applicability for further studies.

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Data availability

The data generated from this study might be available on the valid request.

Informed consent statement

No informed consent was required to conduct the study.

Conflict of interest

The authors declare no conflict of interest.

Authors' contribution

Conceptualization, methodology, data collection and preparing original manuscript: Deepanjana Sarker; **Conducted data analysis and interpretation of result:** A.S.M. Mohiuddin; **Data collection, performing tests and writing:** Bristi Devnath and Md. Muraduzzaman; **Data analysis and manuscript formatting:** Partha Pratim Ghosh; **Manuscript formatting, reviewed it and revised the final manuscript:** Kazi Abdus Sobur. All authors critically reviewed the manuscript and agreed to submit final version of the article.

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