International Journal of Livestock Research, Vol. 12 (2) Feb'2022
http://www.ijlr.org
eISSN: 2277-1964

Original Research

Hematobiochemical and Electrolyte Profile in Feline Panleukopenia Affected Cats

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How to cite this paper:
Kadam, M., Sawale, G., Gandge, R., & Ingle, S. (2022). Hematobiochemical and Electrolyte Profile in Feline Panleukopenia Affected Cats. International Journal of Livestock Research, 12(2), 17-22. doi: 10.5455/ijlr.20220222015425

Received : Dec 20, 2021
Accepted : Jan 20, 2022
Published : Feb 28, 2022

Abstract

A total of fifty faecal samples were taken from the cats or kittens of different ages groups for diagnosis of feline panleukopenia out of which 35 were positive for FPL by PCR method and the blood and serum samples from FPL affected cats were considered for this study. Haematological studies revealed anaemia and leucopenia due to neutropenia and lymphopenia with relative monocytosis in FPL affected cats. Biochemical studies in feline panleukopenia affected cats revealed a significant increase in liver-specific enzymes viz. ALT, AST, and ALP without any alteration in TP, Albumin, Globulin, and AG ratio of FPL affected cats as compared to corresponding values of apparently healthy cats. The KFT parameters revealed a marginal increase in mean values of serum Creatinine and BUN in FPL affected cats. A significant decrease in serum values of Sodium, Potassium, and Chloride in FPL affected cats was observed as compared to corresponding values of apparently healthy cats.

Keywords: Cat, Electrolyte balance, Feline panleukopenia, Haematobiochemical alteration, Kidney Function Test, Liver Function Test

Introduction

Feline panleukopenia is a highly contagious disease of cats and other felids such as wild cats, cheetah, and tigers, and is caused by the feline parvovirus. Kittens below 6 months aremost severely affected by the virus. The unique feature of parvovirus is that the virus requires dividing cells for viral DNA synthesis to occur. This restricts lesions to those tissues in which cells are undergoing mitosis (Vegad and Kataria., 2016). Hence, lesions are commonly observed in cells with high mitotic activity such as lymphoid tissue, bone marrow, and intestinal crypt cells and result in panleukopenia i.e., neutropenia and lymphopenia (Stuetzer and Hartmann, 2014). Although the studies on alteration in hematological and biochemical parameters have been studied well in canine parvovirus in dogs and reported anaemia and leukopenia by Dogra and Sood, (2016), Terzungwe (2018), and Khare *et al*. (2020), and elevated serum levels of liver-specific enzyme by Kaur *et al*. (2005), Baruah *et al.* (2007) and Khare*et al*. (2020); whereas a decrease in serum level of the electrolyte by Haligur *et al*. (2009), Joshi *et al.* (2012) and Kataria *et al*. (2020).

However, studies are lacking on alteration in haematobiochemical and electrolyte parameters due to feline panleukopenia virus in cats. Although few studies outside India have been reported (Parrish, 1995; Mosallanejad *et al*., 2009; Porporato *et al.* 2018; Zenad and Radhy, 2020) and indicated leukopenia, lymphopenia and neutropenia.

Materials and Methods

Total fifty blood samples were collected from cats/kittens showing signs of diarrhoea, dehydration, and vomiting. The fecal samples from these cats were also collected and subjected for diagnosis of feline panleukopenia by polymerase chain reaction using forward primer FM-F (5-GCTTTAGATGATACTCATGT-3 and reverse primer FM-R (5-GTAGCTTCAGTAATATAGTC-3) to amplify 698 bp of the single-copy conserved 5 ends of the VP genes (Mochizuki *et al*., 1996).

The details of PCR conditions used:

	Initial denaturation	**Denaturation**	**Annealing**	**Extension**	**Final extension**
Temp.	95ºC	95ºC	49ºC	72C	72ºC
Time	3min.	1min.	2 min.	45 sec.	10 min.
		35 cycles			

The sample found positive for FPL by PCR test were considered for haemato-biochemical and electrolyte study. In addition to this, apparently healthy cats (10 number) for routine check-up were included in the study as a control group, and theblood and serum samples were collected and examined for haemato-biochemical comparison (control group) with that of FPL affected cats. The data of hematology and biochemical parameters of the feline panleukopenia affected cat (affected group) and apparently healthy cats (control group) were subjected to statistical analysis and differences between the means were tested by using Student t-test and the significance level was set at ($P<0.05$) (Snedecor and Cochran, 1994).

Haematology

The samples were collected in an EDTA vial for complete blood count (CBC) and were performed in an Automatic Cell Counter (MINDRAY BC 3000) as per the instruction of the company. Differential leucocyte count (DLC) was done by manual method (Weiss and Wardrop, 2011). The blood smear was prepared immediately after collecting blood, stainedwith field stain (Himedia, India) and counted 100 cells manually, and presented in percent.

Serum Biochemistry and Electrolyte

The blood was collected in a clot activator vacutainer and allowed to stand in a slanting position for half an hour, centrifuged at 3000 RPM and serum was separated and kept at -20 ^{0}C until further use. The serum was subjected to know any alteration in Liver Function Test (LFT) parameters *viz*. Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), Alkaline phosphatase (ALP), Total protein (TP), Globulin and A: G ratio; Kidney Function Test (KFT) parameters *viz.* Blood Urea Nitrogen (BUN) andCreatinine, and electrolytes balance (Sodium-Na, Potassium-K, and Chloride-Cl). Serum biochemical and electrolyte parameters were estimated by semi-automatic

serum biochemical analyzer (Erba – Chem.7, USA), using reagent kits from Transasia Bio-medicals Ltd., Solan (HP), and methodology as suggested by the manufacturer.

Results and Discussion

A total of fifty faecal samples were collected from the suspected cats or kittens of different age groups out of which 35 were positive for FPL by PCR method. The blood and serum of 35 FPL affected cats were included for hematology, biochemical, and electrolyte profile study. In haematological studies, the mean ± S.E. values of Hb, PCV, TEC, MCV, MCH, MCHC, TLC, Neutrophils, Lymphocytes, Monocytes. Eosinophils and Basophils in FPL affected cats are given in Table 1. The study indicated non-significant decrease in Hb (11.38 ± 0.46), RBC (6.05 ± 0.26), PCV (36.25 ±1.23), MCV (60.72 ± 2.20), MCH (20.45 ± 1.43) and MCHC (31.51 ± 0.16) as compared to Hb (12.65 ± 0.55), RBC (6.79 ± 0.85), PCV (37.93 ± 3.68), MCV (57.6 ± 7.5) and MCHC (33.1 ± 0.48) of apparently healthy cats.

Table 1: Mean values of hematological parameters in FPL affected and apparently healthy cats

Parameter	**FPL affected cases**	**Apparently healthy cats**
	Mean ± S.E.	**Mean ± S.E.**
Hb (g/dl)	11.38 ± 0.46	12.65 ± 0.55
RBC (10^6/cumm)	6.05 ± 0.26	6.79 ± 0.85
PCV (%)	36.25 ± 1.23	37.93 ± 3.68
MCV (fl)	60.72 ± 2.20	57.6 ± 7.5
MCH (pg)	20.45 ± 1.43	19.4 ± 1.40
MCHC (g/dl)	31.51 ± 0.16	33.1 ± 0.48
TLC (10^3 / cumm)	8546.71 ± 374	26810 ± 14662.38
N (%)	66.77 ± 0.44	68.4 ± 0.67
L (%)	26.22 ± 0.36	29.1 ± 0.56
M (%)	6.11 ± 0.26	2.5 ± 0.22
E (%)	0.62 ± 0.13	00 ± 00
B (%)	0.25 ± 0.7	00 ± 00

In the present study, total leucocyte count (8546.71 ± 374) was significantly decreased in feline panleukopenia affected cats as compared to TLC (26810 ± 4662.38) of apparently healthy cats (Table 1).

Differential leucocyte count revealed a significant decrease in Neutrophils (66.77 ± 0.44), Lymphocyte count (26.22 ± 0.36), and relative increase in Monocyte count (6.11 ± 0.26) in FPL affected cats as compared to Neutrophils (68.4 ± 0. 67), Lymphocyte count (29.1 ± 0.56) and Monocyte's count (2.5 ± 0.22) of apparently healthy cats. However, the Monocyte counts of FPL affected cats were within the reference range (Weiss and Wardrop, 2011). Whereas, there was no appreciable alteration in the values of Eosinophils (0.62 ± 0.13) and Basophils (0.25 ± 0.7) count of affected group in both the group. These findings are in accordance with the observation of Mosallanejad *et al*. (2009), Bayati (2016), Porporato *et al.* (2018), Radhy and Zenad (2019) who reported neutropenia and lymphopenia in FPL affected cats. Parrish (1995) reported that panleukopenia or lymphopenia in FPL affected cats is due to replication of FPL virus in progenitors' cells of bone marrow, and causes destruction of cells which may result into reduced neutrophil levels. The target cells of the FPL virus is lymphocytes and thus infect and causes lymphocytolysis. Also, migration of lymphocytes in FPL affected cat's results into lymphopenia commonly observed in FPL cases (Rohovsky, and Griesemer, 1967). Moreover, the FPL virus infect and replicates in early progenitor cells of bone marrow which causes destruction of all myeloid precursor cell population leading to lymphopenia, neutropenia and thrombocytopenia (*i.e.*, panleukopenia) observedin FPV-infected cats (Truyen *et al.*, 2009).

Serum Biochemical Alteration in Feline Panleukopenia

Alteration in serum Liver Function Test (LFT) parameters

The observations of mean ± S.E values of ALT, AST, ALP, Total protein (TP), Albumin, Globulin, and A: G ratio of affected and apparently healthy catsare given in Table 2. The study indicated a significant increase in serum values of ALT(70.47 ± 6.95), AST (51.55 ± 7.00), and ALP (68.15 ± 7.06). However, no significant alteration was noticed in TP (7.23 ± 0.24), Albumin (2.55 ± 0.07), Globulin (4.67 ± 0.21) and AG ratio (0.58 ± 0.02) as compared to ALT (41.67 ± 5.02), AST (35.67 ± 3.29) ALP (50.35 ± 6.21), TP (7.01 ± 0.27), Albumin (2.46 ± 0.12), Globulin (4.54 ± 0.31) and AG ratio (0.56 ± 0.06) level of apparentlyhealthy cats.

Table 2: Mean values of Serum biochemical parameters (LFT) in FPLaffected and apparentlyhealthy cats

Parameter	**FPL affected cats**	**Apparentlyhealthy cats**
	Mean ± S.E.	Mean ± S.E.
ALT (u/L)	70.47 ± 6.95	41.67 ± 5.02
AST (u/L)	51.55 ± 7.00	35.67 ± 3.29
ALP (u/L)	68.15 ± 7.06	50.35 ± 6.21
Total protein (gm/dl)	7.23 ± 0.24	7.01 ± 0.27
Albumin (gm/dl)	2.55 ± 0.07	2.46 ± 0.12
Globulin (gm/dl)	4.67 ± 0.21	4.54 ± 0.31
A/G Ratio	0.58 ± 0.02	0.56 ± 0.06

Increase in the liver-specific enzyme (AST, ALT, and ALP) observed in the present investigation are in harmony with a study carried out by Cowell (2014) who reported that cat affected with gastrointestinal (GI) tract infection had a higher level of all the liver enzymes than normal as liver plays an important role in detoxification of toxins. Similarly, a high rise in liver-specific enzymes was reported in canine parvovirus (CPV) infection by Khare*et al*. (2020), Kaur *et al*. (2005), and Baruah *et al.* (2007). The increase in ALT and AST activity in CPV infection results due to hepatic hypoxia secondary to severe hypovolemia or might be due to absorption of the toxic substance absorbed from the GI tract (Macintire and Smith, 1997). The serum levels of TP, globulin, and A: G ratio were within normal ranges. On contrary, Cowell (2014) reported a decrease in albumin and globulin levels due to severe diarrhoea as a result of leakage of these enzymes through the damaged intestine. However, variation in these parameters (TP, albumin, and globulin) could be due to smaller sample size. Also, the serum level of these parameters may depend upon the stage of disease, duration since the cat was affected and time at which blood sample was collected as the sample taken in the early phase of infection may not have a marked effect on the intestinal mucosa and thereby serum level of TP, albumin, and globulin.

Alteration in Serum Kidney Function Test Parameters

The observations of mean ± S.E values of BUN and Creatinine of affected and apparently healthy cats are given in Table 3. There was a slight increase in mean values of BUN (22.55 ± 1.52) and Creatinine (1.53 ± 0.28) of FPL affected cats as compared to BUN (20.03 ± 1.6) and 1.40 ± 0.08) of apparently healthy cats. More or less similar findings were observed by Kataria *et al*. (2020). Cowell (2004) suggested that a slight increase in BUN and creatinine occursin animals affected with GI tract disorder as a result of hemoglobin degradation by intestinal enzymes. The literature on alteration in kidney function test parameters in cats affected withFPL is meager.

Table 3. Mean (± S.E) values of Serum biochemical parameters (KFT) in FPL affected and apparently healthy cats

Parameter	**FPL affected cats**	**Apparently healthy cats**
Creatinine (mg/dl)	1.53 ± 0.28	1.40 ± 0.08
BUN (mg/dl)	22.55 ± 1.52	20.03 ±1.6

Alteration in Serum Electrolytes

The observations of mean ± S.E values of sodium, potassium, and chloride of affected and apparently healthy cats are given in Table 4. There was a significant decrease in Sodium (119.37 ± 3.04), Potassium (2.72 ± 0.10), and

Chloride (91.66 ± 1.59) levels in FPL affected cats as compared to Sodium (141 ± 0.92), Potassium (3.88 ± 0.12), and Chloride (99.59 ± 1.30) of apparently healthy cats. Katariya *et al*. (2020) reported low levels of serum sodium, potassium, and chloride in dogs affected with parvoviral infection as compared to the control group. They reported that hypokalemia in parvoviral infection might be dueto the loss of potassium in the diarrheic fluid along with sodium and bicarbonate. Haligur *et al*. (2009) and Joshi *et al*. (2012) reported that hyponatremia and hypochloremia in animals affected with gastrointestinal infection irrespective of etiology results due to severe vomiting, diarrhoea, and dehydration. The literature on alteration in kidney function test parameters in catsaffected with FPL is meager.

Table 4: Mean (± S.E) values of serum electrolytes in FPL affected and apparently healthy cats

Parameter	FPL affected cats	Apparently healthy cats
Sodium (mEq/L)	119.37 ± 3.04	141 ± 0.92
Chloride (mEq/L)	91.66 ± 1.59	99.59 ± 1.30
Potassium (mEq/L)	2.72 ± 0.10	3.88 ± 0.12

Conclusion

In conclusion, a hematological study in FPL affected cats revealed anemia, neutropenia an,d lymphopenia whereas biochemical parameters showed an increase in liver-specific enzymes and renal function parameters and decreases in serum proteins and serum electrolytes (Na, K, Cl) as compared to corresponding values in apparently healthy cats.

Conflict of Interests

There is no conflict of interest.

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