



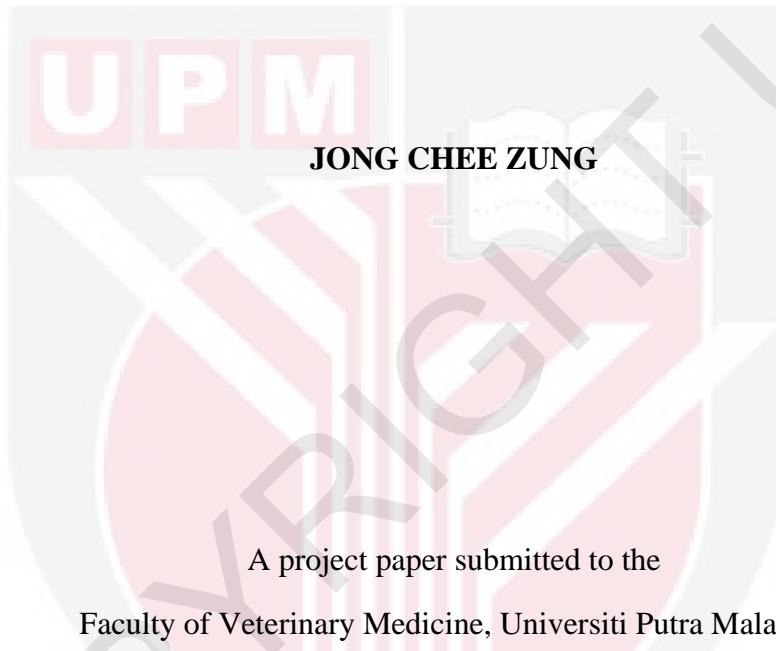
**UNIVERSITI PUTRA MALAYSIA**

***PATTERN OF HAEMATOLOGY AND SERUM BIOCHEMISTRY  
PARAMETERS IN CATS SUSPECTED OF FELINE INFECTIOUS  
PERITONITIS PRESENTED TO UNIVERSITY VETERINARY  
HOSPITAL, UNIVERSITI PUTRA MALAYSIA FROM THE YEAR  
2014 TO 2016***

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**FPV 2017 20**

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UNIVERSITI PUTRA MALAYSIA FROM THE YEAR 2014 TO 2016**



A project paper submitted to the  
Faculty of Veterinary Medicine, Universiti Putra Malaysia  
In partial fulfilment of the requirement for the  
DEGREE OF DOCTOR OF VETERINARY MEDICINE

Universiti Putra Malaysia  
Serdang, Selangor Darul Ehsan.

MARCH 2017

## CERTIFICATION

It is hereby certified that we have read this project paper entitled "Pattern of Haematology and Serum Biochemistry Parameters in Cats Suspected of Feline Infectious Peritonitis presented to University Veterinary Hospital, Universiti Putra Malaysia from the year 2014 to 2016", by Jong Chee Zung and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfilment of the requirement for the course VPD 4999 – Final Year Project.

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## DEDICATIONS

**This project is dedicated to the One Almighty God, who created me and made  
all things possible,**

To my beloved family,

Late father, Dr. Jong Kim Hock

Mother, Hu Hock Lai

Sister, Grace Jong

Brother, Daniel Jong

And to all my respectful lecturers and staff who have committed themselves towards  
the noble cause of education

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**LIST OF ABBREVIATIONS**

Abbreviation	Meaning
ALP	Alkaline Phosphatase
ALT	Alanine Aminotransferase
A:G	Albumin to Globulin Ratio
ASH	American Shorthair
BSH	British Shorthair
CI	Confidence Interval
DLH	Domestic Longhair
DSH	Domestic Shorthair
ELISA	Enzyme-linked Immunosorbent Assays
FCoV	Feline Coronavirus
FECV	Feline Enteric Coronavirus
FIP	Feline Infectious Peritonitis
FIPV	Feline Infectious Peritonitis Virus
RBC	Red Blood Cell
OR	Odds Ratio
P	P-value
PCV	Packed Cell Volume
S.D.	Standard Deviation
UPM	Universiti Putra Malaysia
UVH	University Veterinary Hospital
WBC	White Blood Cell

**ABSTRAK**

Abstrak daripada kertas yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan Kursus VPD 4999 – Projek Ilmiah

Tahun Akhir

**CORAK HEMATOLOGI DAN SERUM BIOKIMIA PARAMETER DALAM  
KUCING YANG DISYAKI RADANG PERITONEUM BERJANGKIT FELIN  
YANG DIKEMUKAKAN KE HOSPITAL VETERINAR UNIVERSITI,  
UNIVERSITI PUTRA MALAYSIA DARI TAHUN 2014 HINGGA 2016**

Oleh

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**2017**

**Penyelia: Prof. MadyaDr. Hazilawati Hj. Hamzah**

**Penyelia Bersama: Prof. MadyaDr. Goh Yong Meng**

Radang peritoneumberjangkit felin (FIP) adalah penyakit immunopatologi maut yang disebabkan oleh felin koronavirusbermutasi yangdijumpai dalam kedua-dua kucing liar dan jinak.Kini, kajian tempatan pada corak hematologi dan serumbiokimia parameter pada kucing FIP adalah amat terhad.Oleh itu, kajian ini dijalankan untuk menentukan corak hematologi dan serumbiokimia parameter pada

kucing yang disyaki FIP yang dikemukakan ke UVH, UPM dan juga untuk membuat perbandingan pada parameter tersebut antara FIP jenis basah dan FIP jenis keing. Rekod perubatan kucing yang disyaki FIP dengan sejarah dan latar belakang sertajumpaan klinikal dari tahun 2014 hingga 2016 telah dikaji dan kriteria kemasukan tunggal adalah kucing yang diuji antibodi terhadap FCoV dengan menggunakan *dot-ELISA*, *Biogal's Immunocomb® Feline Coronavirus Antibody Test Kit* dan mempunyai sederhana hingga tinggi positif FCoV titer antibodi (S3-S6). Data pesakit (umur, jantina dan baka), keputusan hematologi dan serum biokimia telah diperoleh. Antara 132 kucing yang disyaki FIP, 81.1% mempunyai hiperproteinemia, 88.6% mempunyai hiperglobulinemia, 97.7% mempunyai nisbahA:G  $\leqslant$  0.8 dan 46.2% mempunyai hipoalbuminemia dalam keputusan serum biokimia manakala 47.8% mempunyai neutrofilia dengan peralihan kiri, 44.7% mempunyai limfopenia, 41.7% mempunyai monositosis, 55.3% mempunyai eosinopenia, dan 31.8% mempunyai anemia yang tidak jana semula. Parameter seperti kiraan limfosit (P = 0.002), kiraan eosinofil (P = 0.009), jumlah protein (P = 0.000), albumin (P = 0.000), globulin (P = 0.041), ALT (P = 0.016), ALP (P = 0.025) dan creatinine (P = 0.047) didapati berbeza dengan nyata sekali antara FIP jenis kering dan FIP jenis basah.

Kata Kunci: Radang peritoneumberjangkit felin, hiperproteinemia, hyperglobulinemia

## ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine,  
UPM in partial fulfilment for the course of VPD 4999- Final Year Project

**PATTERN OF HAEMATOLOGY AND SERUM BIOCHEMISTRY  
PARAMETERS IN CATS SUSPECTED OF FELINE INFECTIOUS  
PERITONITIS PRESENTED TO UNIVERSITY VETERINARY HOSPITAL,  
UNIVERSITI PUTRA MALAYSIA FROM THE YEAR 2014 TO 2016**

By

**Jong Chee Zung**

**2017**

**Supervisor: Assoc. Prof. Dr. Hazilawati Hj. Hamzah**

**Co-supervisor: Assoc. Prof. Dr. Goh Yong Meng**

Feline Infectious Peritonitis (FIP) is a lethal immunopathological disease caused by mutated feline enteric coronavirus found in both wild and domesticated cats. There are limited local studies on the pattern of haematological and serum biochemical parameters in FIP cats. Thus, this study was conducted to determine the pattern of haematological and serum biochemical parameters in suspected FIP cats presented to UVH, UPM and also to compare these parameters between dry form and wet form

FIP. Medical records of cats suspected of FIP with compatible history and clinical signs admitted to UVH from year 2014 to 2016 were reviewed and the sole inclusion criterion was cats tested for FCoV antibody using dot-ELISA, Biogal's Immunocomb® Feline Coronavirus Antibody Test Kit with medium to high positive FCoV antibody titre (S3-S6). Data on signalment (age, sex and breed), haematology and serum biochemistry results were obtained. Among the 132 suspected FIP cats, 81.1% had hyperproteinaemia, 88.6% had hyperglobulinaemia, 97.7% had A:G ratio $\leq$  0.8 and 46.2% had hypoalbuminaemia, 47.8% had neutrophilia with left shift, 44.7% had lymphopaenia, 41.7% had monocytosis, 55.3% had eosinopaenia, and 31.8% had nonregenerative anaemia. Parameters such as lymphocyte count ( $P=0.002$ ), eosinophil count ( $P=0.009$ ), total protein ( $P=0.000$ ), albumin ( $P=0.000$ ), globulin ( $P=0.041$ ), ALT ( $P=0.016$ ), ALP ( $P=0.025$ ) and creatinine ( $P=0.047$ ) were found to be significantly different between dry form and wet form FIP.

Keywords: Feline infectious peritonitis, hyperproteinaemia, hyperglobulinaem

## 1.0 INTRODUCTION

Feline Infectious Peritonitis (FIP) is a lethal immunopathological disease characterized as an immune-mediated pyogranulomatous vasculitis caused by mutated feline coronavirus (FCoV), known as feline infectious peritonitis virus (FIPV) which can be found in both wild and domesticated Felidae (Pedersen & Floyd, 1985; IDEXX, 2015). Its morbidity is low and barely surpasses 5% of infected cats despite the generally high prevalence of FCoV infection in the cat population, which can exceed 90% in multicat environment (reviewed by Pedersen, 2009).

Several studies reported FIP significantly more often in male cats (Rohrbach *et al.*, 2001; Norris *et al.*, 2005) and approximately 50% of FIP cats diagnosed worldwide are less than 2 years old with over representation of purebred cats (Norris *et al.*, 2005). FIP is divided into two distinct clinical forms which are dry form and wet form (Goodson *et al.*, 2009). Wet form FIP is caused by complement-mediated vasculitis initiated by immune complex deposition in vessel walls while dry form FIP results when a cell-mediated immune response dominates and granulomas form in various organs (Pesteanu-Somogyi, 2005).

Nonregenerative anaemia, neutrophilic leukocytosis, lymphopaenia and hyperproteinaemia are well-recognized haematological and serum biochemical findings in FIP (Jain, 1993; Pedersen, 1995). In Malaysia, there is limited study on the pattern of haematological and serum biochemical parameters in FIP cats.

Moreover, data regarding comparison of these parameters between dry form and wet form FIP cats are also lacking. Thus, this study was conducted with the following objectives:

- i. to determine the pattern of haematological and serum biochemical parameters in cats suspected of FIP presented to UVH, UPM
- ii. to compare the haematological and serum biochemical parameters in cats suspected of dry form and wet form FIP.

Significant differences for certain parameters between dry form and wet form FIP might contribute to its diagnostic value.

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