



UNIVERSITI PUTRA MALAYSIA

***OCCURRENCE OF ANTIBIOTIC RESISTANT *Salmonella* spp. IN
STRAY AND OWNED CATS***

NUR FARAWAHIDAH BINTI MOHSIN

FPV 2016 36

OCCURRENCE OF ANTIBIOTIC RESISTANT *Salmonella* spp.

IN STRAY AND OWNED CATS

NUR FARAWAHIDAH BINTI MOHSIN

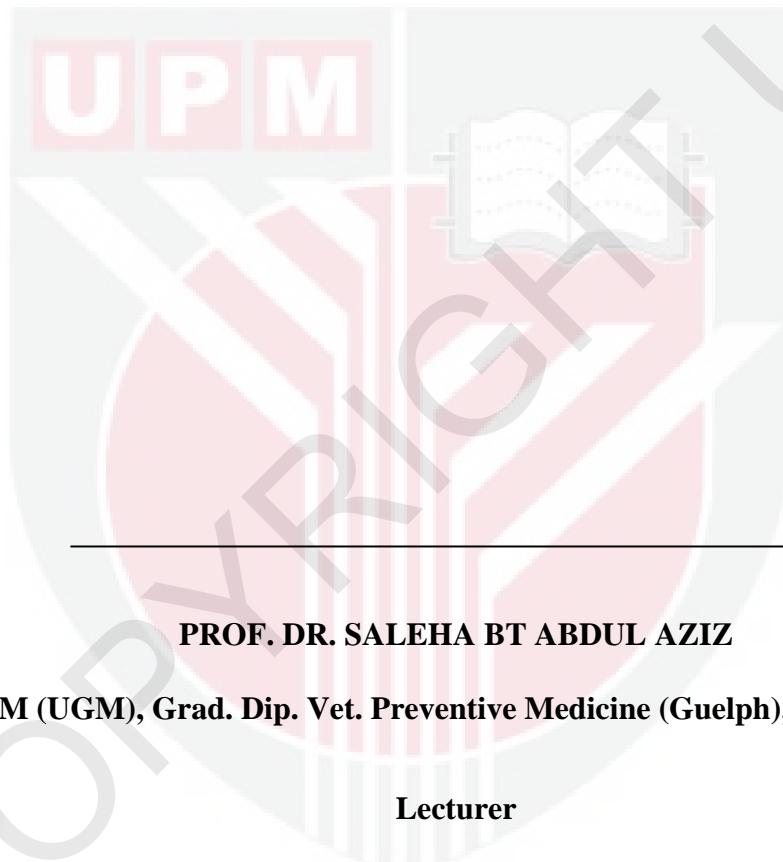
**A project submitted to the
Faculty of Veterinary Medicine,
Universiti Putra Malaysia**

**In partial fulfilment of the requirement for the
DEGREE OF DOCTOR VETERINARY MEDICINE**

**Universiti Putra Malaysia
Serdang, Selangor Darul Ehsan**

MARCH 2016

It is hereby certified that I have read this project paper entitled “Occurrence Of Antibiotic Antibiotic Resistant *Salmonella* Spp. In Stray and Owned Cats”, by Nur Farawahidah Binti Mohsin and in my 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.



PROF. DR. SALEHA BT ABDUL AZIZ

DVM (UGM), Grad. Dip. Vet. Preventive Medicine (Guelph), PhD (UPM)

Lecturer

Faculty of Veterinary Medicine

Universiti Putra Malaysia

(Supervisor)

To

My beloved mother and father,

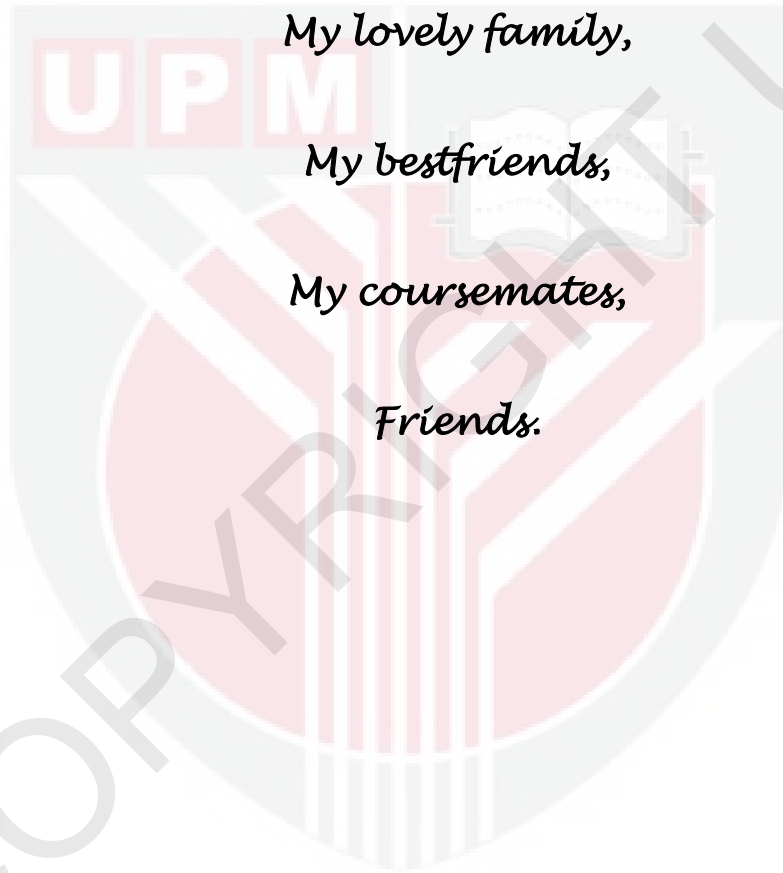
Mohsin bin Mudakir and Norlidah Ahmad,

My lovely family,

My bestfriends,

My coursemates,

Friends.



© COPYRIGHT

ACKNOWLEDGEMENTS

Alhamdulillah,

First and foremost, I would like to thank ALLAH SWT GOD ALMIGHTY, for giving me strength, patience, passion and ideas to finish up this project.

I would like to express my sincerest gratitude and appreciation to my supervisor, Prof. Dr. Saleha Abdul Aziz, for her support, close supervision, guidance and patience throughout the process of this project. A million thanks for your willingness to share your knowledge and experience in this field.

I feel grateful to having Dr. Nur Indah Ahmad and also Puan Fauziah for their aid and guidance throughout the course of this project. Thank you for your patience in resolving all problems that arose during the project. Sincere gratitude to Veterinary Public Health laboratory mates, Fadhilah, Liyana, Thivya, Faridah, Aina, Stephanie and Lau Jee Bin, whom contributed their time and energy to help make this project possible.

Special appreciation also dedicated to my beloved family whom have given me love, care, moral support and assistance to successfully done this project.

Lastly, I would like to thank all my friends, course mates and all staff of Faculty of Veterinary Medicine for their help in one way or another.

TABLE OF CONTENTS

	Page
TITLE	i
CERTIFICATION	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	vii
LIST OF FIGURE	viii
LIST OF PLATES	ix
ABSTRACT	x
ABSTRAK	xii
1.0 INTRODUCTION	1
2.0 LITERATURE REVIEW	3
2.1 <i>Salmonella</i> spp.	3
2.2 Prevalence of <i>Salmonella</i> spp. in Cats	3
2.3 Antimicrobial Usage and Antimicrobial Resistance	
Microorganism in Pet Animals	4
2.4 Public Health Significance	6
3.0 MATERIALS AND METHODS	7
3.1 Study Design	7
3.2 Sources of Sample	7

3.3 Samples Collection	8
3.4 Sample Storage	8
3.5 Isolation of <i>Salmonella</i> spp.	8
3.6 <i>Salmonella</i> spp. Identification Test	9
3.7 Antibiotic Sensitivity Test	11
3.8 <i>Salmonella</i> spp. Serotyping	12
4.0 RESULTS	13
4.1 Isolation of <i>Salmonella</i> spp. from Rectal Swab of Cats	13
4.2 Identification of <i>Salmonella</i> spp.	14
4.3 Antibiotic Sensitivity Test	14
5.0 DISCUSSION	19
6.0 CONCLUSION	22
7.0 RECOMMENDATION	23
8.0 REFERENCES	24
9.0 APPENDIX	26

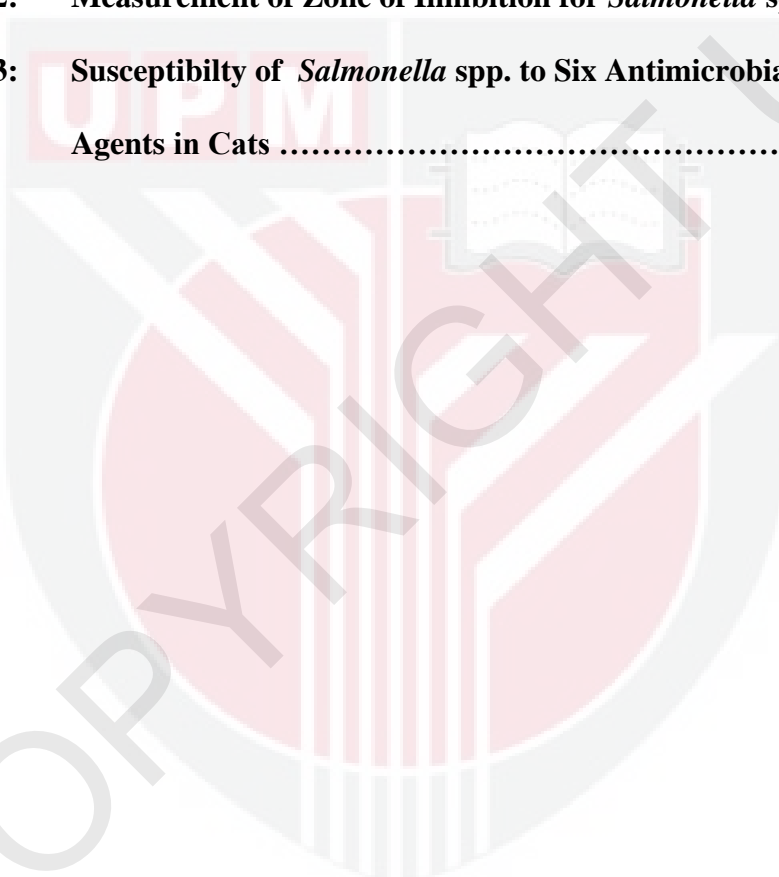
LIST OF TABLES

	Page
Table 1: Isolation of <i>Salmonella</i> spp. in cats	13
Table 2: Measurement of Zone of Inhibition for <i>Salmonella</i> spp.	17
Table 3: Susceptibility of <i>Salmonella</i> spp. to Six Antimicrobial Agents in Cats	17



COPY

RIGHT



UPM

LIST OF FIGURES

	Page
Figure 1: Susceptibility of <i>Salmonella</i> spp. to six different antibiotics...	18



© COPYRIGHT

UPM

LIST OF PLATES

	Page
Plate 1: <i>Salmonella</i> spp. colonies on Xylose Lysine Deoxycholate (XLD) agar	15
Plate 2: <i>Salmonella</i> spp. colonies on Brilliant Green Agar (BGA)	15
Plate 3: Positive Result on Biochemical Tests (TSI, Urease, LIA, Citrate, SIM)	16
Plate 4: Antibiotic Sensitivity Test	16

ABSTRACT

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

**OCCURRENCE OF ANTIBIOTIC RESISTANT *Salmonella* spp.
IN STRAY AND OWNED CATS**

By

Nur Farawahidah Binti Mohsin

2016

Supervisor: Prof. Dr. Saleha Bt. Abdul Aziz

Salmonellosis is an important zoonotic disease worldwide. The organisms reside commonly in the gastrointestinal tracts. Cats are most widely kept pet animals, yet the risk that these animals pose for transmission of *Salmonella* to humans is unclear. Free roamer and stray cats are potential candidates for *Salmonella* carriage and might contribute actively to the contamination of environment. The objectives of this study were to determine the occurrence of *Salmonella* spp. and to determine the antimicrobial resistance of *Salmonella* spp. in stray and owned cats. A

total of 60 rectal swab samples were collected which consisted of 30 from owned cats at veterinary clinics and individual owners and the other 30 samples were taken from stray cats at residential areas and food stalls. Out of 60 cats, only three (5%) were positive for *Salmonella* spp. which were from stray cats (10%). The *Salmonella* spp. isolated were tested against six different antibiotics namely ampicillin, chloramphenicol, ciprofloxacin, gentamicin, sulfamethoxazole-trimethoprim and nalidixic acid. All three (100%) isolates were resistant to ampicillin, but susceptible to ciprofloxacin, and one (33%) isolate was susceptible to gentamicin and chloramphenicol. This could be expected as stray cats are often exposed to intestinal infection with *Salmonella* species than pet household cats. Stray cats may pose a potential threat to public health and their faecal materials may play significant roles in the contamination of environment.

Keywords: Stray cats, owned cats, *Salmonella* spp., antibiotic resistant

ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar sebagai memenuhi sebahagian daripada kursus VPD 4999 – Projek Ilmiah Tahun Akhir.

**KEHADIRAN *Salmonella* spp. TAHAN ANTIBIOTIK DIASINGKAN
DARIPADA KUCING LIAR DAN PELIHARAAN ORANG**

Oleh

Nur Farawahidah Binti Mohsin

2016

Penyelia: Prof. Dr. Saleha Bt. Abdul Aziz

Salmonellosis adalah penyakit zoonotik penting di seluruh dunia. Organisma ini biasanya tinggal dalam saluran pencernaan. Kucing adalah haiwan yang paling banyak dipelihara sebagai haiwan kesayangan, namun risiko haiwan ini dalam pemindahan *Salmonella* kepada manusia adalah tidak jelas. Kucing ‘free-roamer’ dan kucing liar berpotensi menyebarkan *Salmonella* dan menyumbang secara aktif kepada pencemaran alam sekitar. Objektif kajian ini adalah untuk menentukan

kehadiran *Salmonella* spp. dan untuk menentukan rintangan antimikrob *Salmonella* spp. dalam kucing liar dan kucing peliharaan orang. Sebanyak 60 sampel swab rektum dikumpulkan yang terdiri daripada 30 dari kucing peliharaan di klinik veterinar dan pemilik individu dan 30 sampel selebihnya diambil dari kucing liar di kawasan perumahan dan gerai-gerai makanan. Daripada 60 kucing, hanya tiga (5%) didapati positif *Salmonella* spp. yang juga merupakan daripada kucing liar (10%). *Salmonella* spp. yang diasingkan telah diuji terhadap enam antibiotik yang berbeza iaitu ampicillin, chloramphenicol, ciprofloxacin, gentamicin, sulfamethoxazole-trimethoprim dan nalidixic acid. Ketiga-tiga (100%) sampel menunjukkan ketahanan terhadap antibiotik ampicillin, tetapi sensitif kepada ciprofloxacin, dan satu (33%) sampel sensitif kepada gentamicin dan chloramphenicol. Ini boleh dijangka kerana kucing liar seringkali terdedah kepada jangkitan usus dengan spesies *Salmonella* berbanding kucing dipelihara orang. Kucing liar boleh menimbulkan ancaman yang berpotensi kepada kesihatan awam dan bahan-bahan najis mereka boleh memainkan peranan penting dalam pencemaran alam sekitar.

Kata kunci: kucing liar, kucing dimiliki, *Salmonella* spp, tahan antibiotik.

1.0 INTRODUCTION

Salmonellosis has long been recognized as an important zoonotic disease of worldwide economic significance. *Salmonella* genus is a member of the Enterobacteriaceae family, comprising Gram-negative rod-shaped nonspore-forming bacteria. The organisms inhabit the intestinal tracts of vertebrate and invertebrate animals worldwide and its excretion results in contamination of environment, feed, water and infected animals (Seepersadsingh *et al.*, 2005; McDonough, 2000). Disease symptoms in human include acute abdominal pain, diarrhoea, nausea, fever, and sometimes vomiting. Mild symptoms are often seen and the infection can also occur without symptoms.

Considering the high frequency of food contamination and the emergence of multidrug-resistant *Salmonella* strains, control of *Salmonella* in food-producing animals has become a worldwide challenge. The role of pet animals as a source of *Salmonella* has not been fully investigated, but severe human infections originating from reptiles, especially pet turtles, have been reported (Immerseel *et al.*, 2004). Cats and dogs are the most widely kept pet animals, yet the incidence of *Salmonella* in these animals is largely unknown, and the risk that these animals pose for transmission of *Salmonella* to humans is unclear. In particular, cats that can freely roam outside, and are able to scavenge or hunt food are potential candidates for *Salmonella* carriage (Immerseel *et al.*, 2004).

Clinical salmonellosis in cats is relatively uncommon and few references on it exist in scientific literature (McDonough, 2000). Cats appear to be highly resistant to *Salmonella* infection unless they are stressed by overcrowding, dietary changes, transport, hospitalization, antimicrobial therapy, or concurrent illness at the time of *Salmonella* exposure (McDonough, 2000). Most reports concerning *Salmonella* and cats are case studies of clinical salmonellosis, which result in septicaemia and death. Subclinical infections and carrier animals, however, are more important with respect to transmission to humans (Immerseel *et al.*, 2004). Since, having cats living closely at home has become more common in Malaysia, epidemiological data of *Salmonella* and antimicrobial resistance patterns are needed in order to prevent and control *Salmonella* spp. in cats. Thus, the objectives of this present study were:

- 1) to study the occurrence of *Salmonella* in cats from owned and stray cats.
- 2) to compare the isolation rate of *Salmonella* between owned and stray cats.
- 3) to determine antibiotic resistance level of *Salmonella* spp. isolated.

8.0 REFERENCES

- Bhaiyat M. I., Hariharan H., Chikweto A., Brathwaite-Sylvester E., Burnett P. J. A., Matthew V., Oliveira S. and Johnson C. (2009). Concurrent lymphosarcoma and *Salmonella enteritidis* infection in a cat: a case report. *Veterinarni Medicina*. **9**: 451- 454.
- Carter M. E. and Quinn P. J. (2000). *Salmonella* in dogs and cats, *Salmonella* in domestic animals. Wray C and Wray A Editors CAB, ISBN, International Publishing. 231- 244.
- Cherry B., Burns A., Johnson G. S., Pfeiffer H., Dumas N., Barrett D. *et al.* (2004). *Salmonella* Typhimurium outbreak associated with veterinary clinic. *Journal of Emerging Infectious Disease*. **10(12)**: 2249–2251.
- Clinical and Laboratory Standards Institute (2007). *Performance Standards for Antimicrobial Susceptibility Testing; Seventeenth Informational Supplement*. CLSI document M100-S17 (ISBN 1-56238625-5). Clinical and Laboratory Standards Institute, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania 19087-1898 USA, 2007.
- Clyde V. L., Ramsay E. C., Bernis D. A. (1997). Fecal shedding of *Salmonella* in exotic felids. *Journal of Zoo and Wildlife Medicine*. **28(2)**: 148-152.
- EMA/ESVAC (2013). European Medicines Agency, Sales of veterinary antimicrobial agents in 25 EU/EEA countries in 2011.
- Escher M., Vanni M., Intorre L., Caprioli A., Tognetti R., Scavia G. (2011). Use of antimicrobials in companion animal practice: a retrospective study in a veterinary teaching hospital in Italy. *Journal of Antimicrobial Chemotherapy*. **66**: 920-927.

Gallaway T., Edrington T., Anderson R., Byd J., Nibest D. (2008). Gastrointestinal microbial ecology and the safety of our food supply as related to *Salmonella*. *Journal of Animal Science*. **86**: E 163- E 172.

German A. J., Halladay L. J., Noble P-J M. (2010). First-choice therapy for dogs presenting with diarrhoea in clinical practice. *Veterinary Record*. **167**: 810-814.

Guardabassi L., Schwarz S., and Llyod D. H. (2004). Pet animals as reservoir of antimicrobial-resistant bacteria. *Journal of Antimicrobial Chemotherapy*. **54**: 321-332.

Hill S. L., Cheney J. M., Taton-Allen G. F., Reif J. S., Bruns C. and Lappin M. R. (2000). Prevalence of enteric zoonotic organisms in cats. *Journal of America Veterinary Medicine Association*. **216**: 687- 692.

Hughes L. A., Williams N., Clegg P., Callaby R., Nuttall T., Coyne K., Pinchbeck G., and Dawson S. (2012). Cross-sectional survey of antimicrobial prescribing patterns in UK small animal veterinary practice. *Journal of Preventive Veterinary Medicine*. **104**:309-316.

Ikeda J. S., Hirsh D. C., Jang S. S., Biberstein E. L. (1986). Characteristics of *Salmonella* isolated from animals at a veterinary medical teaching hospital. *American Journal Veterinary Research*. **47**: 232-235.

Immerseel F. V., Pasmans F., De Buck J., Rychlik I., Hradecka H., Collard J. M., Wildemaauwe C., Heyndrickx M., Ducatelle R. and Haesebrouck H. (2004). Cats as a risk for transmission of antimicrobial drug resistant *Salmonella*. *Journal of Emerging Infectectious Disease*. **10**: 2169-2174.

- Mather A. E., Ried S. W. J., Maskell D. J., Parkhill J., Fookes M. C., Harris S. R., Brown D. J., Coia J. E., Mulvey M. R., Gilmour M. W., Petrovaska L., de Pinna E., Kuroda M., Akiba M., Izumiya H., Connor T. R., Suchard M. A., Lemey P., Mellor D. J., Hayon D. T., and Thomson N. R. (2013). Distinguishable epidemics of multidrug-resistant *Salmonella typhimurium* DT104 in different hosts. *Journal of Science*. **341**: (6153) 1514-1517. 1.
- McDonough P. L. (2000). Salmonellosis. *Maxhouse.com*. Diagnostic Laboratory, College of Veterinary Medicine, Cornell University. <http://maxshouse.com/salmonellosis.htm>
- Mirmomeni M. H., Naderi S., Colagar A. H., Sisakhtnezhad S. (2009). Isolation of *Salmonella enteritidis* using biochemical tests and diagnostic potential of *sdfl* amplified gene. *Research Journal of Biological Sciences*. **4(6)**: 656-661.
- Pitout J.D., Laupland K.B (2008). Extended-spectrum β -lactamase producing *Enterobacteriaceae*: an emerging public health concern. *The Lancet Infectious Disease Journal 2008*. **8(3)**: 159–166.
- Polpakdee A., Angkititrakul S., Suksawat F., Sparagano O., Kanistanon K. (2012). Epidemiology and antimicrobial resistance of *Salmonella* spp. isolated from dogs and cats in Northeastern Thailand. *Journal of Animal Veterinary Advances*. **11(5)**: 61-621
- Public Health England (2015). Identification of *Salmonella* species. *UK Standards for Microbiology Investigations*. Issued by the Standards Unit, Microbiology Services, Public Health England, 61 Colindale Avenue, London NW9 5EQ.
- Seepersadsingh N., Adesiyun A. A., Seebaransingh R. (2005). Serovars and antibiotic sensitivity of *Salmonella* spp. isolated from non-diarrhoeic cats in Trinidad. *Veterinarski Arhiv Journal*. **75**: 223-231, 2005.

- Tankson J. D., Fedorka-Cray P. J., Jackson C. R., Headrick M. (2005). Genetic relatedness of a rarely isolated *Salmonella*: *Salmonella enterica* Niakhar from NARMS animal isolates. *Journal of Antimicrobial Chemotherapy*. **57**: 190-198.
- Thomson K. H., Rantala M. H. J., Viita-Aho T. K., Vainio O. M., Kaartinen L. A. (2009). Condition-based use of antimicrobials in cats in Finland: results from two surveys. *Journal of Feline Medicine & Surgery*. **11**:462-466.
- Wilson M. E. (2004). Summary and comment in January 2005: on cats as a risk for transmission of antimicrobial drug-resistant *Salmonella*. *Journal of Emerging Infectious Disease*. **10**:2169- 2174.
- Zenad M. M., Al-Obaidi T. Q. and Al-Talibi A. M. (2014). Prevalence of *Salmonella species in stray cats in Mosul city, Iraq*. *Online Journal of Animal and Feed Research*. **4(5)**: 133-136.