Cairo University

Faculty of Veterinary Medicine

Zoonoses Department

Public Health Importance of Some Emerging Zoonotic Diseases in Camels

Thesis Presented by

Hala Mahmoud Zaher

(B. V. Sc., 2010)
(M. V. Sc., 2014)

Fac. Vet. Med., Cairo University
For the degree of PhD. V. Sc
(Zoonoses)

Under The Supervision Of

Prof. Dr. Nahed H. Ghoneim

Professor of Zoonoses
Fac. Vet. Med., Cairo University

Prof. Dr. Khaled A. Abdel-Moein

Professor of Zoonoses
Fac. Vet. Med., Cairo University

2018

Cairo University
Faculty of Veterinary Medicine
Zoonoses Department

Approval sheet

This to approve that the dissertation by **Hala Mahmoud Zaher** to Cairo University for the PhD. degree in Veterinary Science (Zoonoses) has been approved by the examining committee:

Signature

Prof. Dr. Asmaa Abd El-Nasser A. Hussien

Professor of Zoonoses
Fac. Vet. Med., Assiut University
Director of molecular biology research unit
Assiut University

Prof. Dr. Osman M. Hamed
Professor of Zoonoses
Fac. Vet. Med., Cairo University

Prof. Dr. Nahed H. Ghoneim
Professor of Zoonoses
Fac. Vet. Med., Cairo University

Prof. Dr. Khaled A. Abdel-Moein
Professor of Zoonoses
Fac. Vet. Med., Cairo University

Date: 17/1/2018

Cairo University

Faculty of Veterinary Medicine

Zoonoses Department

Supervision sheet

Prof. Dr. Nahed H. Ghoneim

Professor of Zoonoses

Fac. Vet. Med., Cairo University

Prof. Dr. Khaled A. Abdel-Moein

Professor of Zoonoses

Fac. Vet. Med., Cairo University

Cairo University
Faculty of Veterinary Medicine
Zoonoses Department

Name : Hala Mahmoud Zaher
Date of birth : 17/6/1988
Nationality : Egyptian
Degree : PhD degree
Specialization : Zoonoses
Title of thesis :Public health importance of some emerging zoonotic diseases in camels

Under supervision of
Prof. Dr. Nahed Hamed Ghoneim
Prof. Dr. Khaled Abdel-Aziz Abdel-Moein

Abstract

Camels were imported to Egypt in large numbers to be slaughtered for meat consumption. The current work was carried out to clarify the role of camels and attached ticks in transmission of emerging zoonotic diseases. For this purpose, a total of 406 adult ticks as well as blood and fecal samples were gathered from 206 apparently healthy slaughtered dromedary camels (181 imported and 25 local camels) in Bassitin abattoir, Cairo. In addition to75 blood and 50 stool samples from human contacts. The laboratory investigation of obtained samples revealed that *Salmonella* serovars were recovered from 17 (8.3%) camel fecal samples while all human stool specimens were negative. All *Salmonella* isolates carried *invA* gene whereas *stn* gene was expressed from 12 isolates mainly exotic ones. Twenty one (5.2%) and fifteen (3.7%) ticks were positive by PCR for *C. burnetii* and *Francisella* spp. respectively but blood and feces of camels including those carrying positive *C. burnetii* and *Francisella* spp. ticks yielded negative results for both pathogens. Moreover, *F. tularensis* was not detected among positive *Francisella* spp. ticks. On the other hand, *C. burnetii* and *F. tularensis* antibodies could be found in camel butchers and slaughterhouse workers with seroprevalence rate 18.7% and 9.3% respectively. In conclusion, this study highlighted that camels could play a critical role in transmission of emerging tick borne diseases such as Q fever and *Francisella* infection as well as exotic *Salmonella* strains across geographical boundaries.
(Keywords: Camels- *Salmonella*- Ticks- *Coxiella burnetii*- *Francisella* spp.)

Acknowledgement

*I am extremely grateful to **Allah** for helping, prosperity, kindness and under whose willing this work was carried out.*

*No word can express my deep sincerest gratitude, and deepest thanks to **Prof. Dr. Nahed H. Ghoneim**, Professor of Zoonoses, Fac. Vet. Med., Cairo University, for her kind encouragement, great interest, valuable advice and unfailing help during the course of this research.*

*All words are unable to express my deepest gratitude and high appreciation to **Prof. Dr. Khaled A. Abdel-Moein**, Professor of Zoonoses, Fac. Vet. Med., Cairo University, for his kind help, continuous interest and valuable advice during the course of this work.*

It is a great pleasure to record my kind gratitude to all members of Zoonoses Dept., Fac. Vet. Med., Cairo University.

LIST OF ABBREVIATIONS

Abbreviation	Name
bp	Base pair
BPW	Buffered peptone water
CDC	Centers for Disease Control and Prevention
FAO	Food and Agriculture Organization
FLEs	*Francisella* like endosymbionts
g	Gram
GOVS	General Organization of Veterinary Services
HIV	Human immunodeficiency virus
InvA gene	Invasion gene
ISO	International Organization for Standardization
MERS-CoV	Middle East respiratory syndrome coronavirus
mg	Milligram
ml	Millilitre
mm	Millimetre

NARMS	The National Antimicrobial Resistance Monitoring System
nm	Nanometre
NTS	Nontyphoidal salmonellosis
PBS	Phosphate buffered saline
qPCR	Quantitative polymerase chain reaction
rpm	Round Per Minute
RV broth	Rappaport-Vassiliadis broth
SPSS	Statistical Package for the Social Sciences
Stn gene	*Salmonella* enterotoxin gene
TBDs	Tick borne diseases
TSI agar	Triple sugar iron agar
µg	Microgram
µl	Microlitre
µM	Micromolar
WHO	World Health Organization
XLD agar	Xylose- Lysine- Desoxycholate agar

LIST OF CONTENTS

Title **Page**

Introduction…….....1

Review of literature……..4

Salmonellosis…….……...….……4

***Salmonella* infection in camel…….…...….……..4**

Occurrence of *Salmonella* pathogen in camel feces……...….....….6

Epidemiological aspect of nontyphoidal *Salmonella* infection……...….……7

***Salmonella* infection in human.....9**

Public health importance of *Salmonella* virulence genes…….……....11

Invasion (*InvA*) gene……...…….....11

***Salmonella* enterotoxin (*Stn*) gene……..12**

Epidemiological aspect of some emerging zoonotic tick borne diseases…….13

Q fever infection…….……..13

Q fever infection in ticks……..…….……..13

Q fever infection in camels……..……...……16

Public health importance of Q fever infection in human……..……...18

***Francisella* spp. infection…….……...……21**

Biology of *Francisella* spp. …….……...……21

***Francisella* spp. infection in ticks…….…….....…….……...22**

***Francisella* spp. infection in camels…….…...……..……..23**

Public health importance of *Francisella* spp. infection in human….…….….24

Co-tick borne infections……..…...…..……...27

Material and Methods…….…….…….…….…29

Material……..…....29

Methods……...38