بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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MONA MAGHRABY

Cairo University
Faculty of Veterinary Medicine

Bacteriological studies on some multidrug resistant pathogens isolated from different animals and their effect on public health

A thesis submitted by

Alzahraa Rabei Attia Ibrahim
Bachelor's degree of Veterinary Science (2013)
Faculty of Veterinary Medicine
Cairo University

For

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Under the Supervision of

Prof. Dr. Ahmed Samir Mohamed
Professor of Microbiology
Faculty of Veterinary Medicine
Cairo University

Prof. Dr. Khaled Abdel-Aziz Abdel-Moein
Professor of Zoonoses
Faculty of Veterinary Medicine
Cairo University

(2021)

Cairo University
Faculty of Veterinary Medicine

SUPERVISION SHEET

Prof.Dr. Ahmed Samir Mohamed

Professor of Microbiology

Faculty of Veterinary Medicine

Cairo University

Prof.Dr. Khaled Abdel-Aziz Abdel-Moein

Professor of Zoonoses

Faculty of Veterinary Medicine

Cairo University

(2021)

Cairo University
Faculty of Veterinary Medicine

Name: Alzahraa Rabei Attia Ibrahim
Date and place of birth: 15.9.1991 - Cairo.
Nationality: Egyptian.
Degree: **M.V.Sc** Veterinary Medicine Sciences.
Specialty: Microbiology.
Supervisors:
Prof.Dr. Ahmed Samir Mohamed
Professor of Microbiology, Faculty of Veterinary Medicine, Cairo University.
Prof.Dr. Khaled Abdel-Aziz Abdel-Moein
Professor of Zoonoses, Faculty of Veterinary Medicine, Cairo University.
Title of thesis: Bacteriological studies on some multidrug resistant pathogens isolated from different animals and th effect on public health

Abstract

" Bacteriological studies on some multidrug resistant pathogens isolated from different animals and their effect on public health" Alzahraa Rabei Attia Ibrahim, Cairo Univ. Fac. Vet. Med. Thesis; : M.V.Sc., Microbiology, 2021.

Nowadays, companion animals as cats, dogs and horses have frequently considered family members and close animal contact occurs daily. Therefore, the transmission of a variety of microorganisms that cause diseases, like multidrug-resistant pathogens between animals and owners has increased and has become a public health issue. Accordingly, the purpose of this study was to investigate the transmission of antibiotic resistant bacteria between companion animals and humans, and more specifically the role of companion animals in transmission of methicillin-resistant *Staphylococcus aureus* (MRSA) and extended spectrum beta-lactamase (ESBL) to humans in varying degrees of contact with these animals. Here, carriage of methicillin-resistant *Staphylococcus aureus* (MRSA) and extended spectrum beta-lactamase (ESBL) producing bacteria in companion animals was assessed. Nasal and rectal samples were cultured on chromogenic media and MaCconkey agar in addition to 0.2 mg cefotaxime directly for detection of MRSA and ESBLs, respectively. Considering MRSA detection; nasal swabs were collected from 134 companion animals with respiratory illness (48 horses, 41 dogs and 45 cats). All swabs were cultured for MRSA using MRSA CHROMagar medium, whereas isolates were identified as MRSA after colonial morphology, biochemical tests Gram staining, coagulase test, resistance to cefoxitin and detection of *mec*A gene. Moreover, antimicrobial resistance patterns for all obtained MRSA isolates were determined by the disk diffusion method. The prevalence rates of MRSA among horses, dogs and cats were 8.3%, 2.4% and 0% respectively. All the MRSA isolates were multidrug resistant. The phylogenetic analysis of 2 *mec*A gene sequences obtained in this study (one from dog and another from horse) revealed that both sequences were grouped in the same clade with sequences derived from human patients to underscore the potential public health implications of such strains. Regarding ESBLs detection, rectal swabs were collected from 135 companion animals with diarrhea (72 dogs, 33 cats and 30 horses). All swabs were cultured on MacConkey agar in addition to 2mg/L cefotaxime to promote selection of β-lactamase producers, incubated for 24 hours at 37 ^{o}c. Isolates were identified as ESBLs after colonial morphology, biochemical tests, Gram staining, and molecular techniques using *TEM*, *SHV*, *CTX*, and *OXA* genes. The prevalence rates of ESBLs in the study were 25.9%, 5.9% and 7.4% in dogs, cats and horses, respectively. 46 isolates out of 53 were E.coli and 7 were Klebsiella pneumoniae. In conclusion, the current study highlights the occurrence of multidrug resistant pathogen as methicillin-resistant Staphylococcus aureus (MRSA) and extended spectrum beta-lactamases (ESBL) among companion animals and the importance of infection control strategies for the protection of animals at risk as well as veterinary personnel.

Keywords: Companion animals, Multi-Drug resistant bacteria, MRSA, ESBL, Public health.

Cairo University
Faculty of Veterinary Medicine

Dedication

I would like to dedicate this work to my father, my mother and brothers, my little sons and my husband Mustafa for whom I am indebted for happiness in my life.

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LIST OF ABBREVIATIONS

Abbreviation	Full name
µl	Microliter
BLAST	Basic Local Alignment Search Tool
bp	base pair
CA MRSA	Community acquired Methicillin resistant *Staphylococcus aureus*
CDC	Centers for Disease Control and Prevention
DNA	Deoxyribonucleic acid
ESBL	*Extended spectrum beta lactamases*
ESCs	Extended spectrum cephalosporin
EU	European Union
Fig	Figure
G	Gram
HA MRSA	Hospital acquired Methicillin resistant *Staphylococcus aureus*
LA MRSA	Livestock acquired Methicillin resistant *Staphylococcus aureus*
MDR	Multidrug resistance
mg/L	milligram/liter
ml	milliliter
MRSA	Methicillin resistant *Staphylococcus aureus*
NAG	N-acetylglucosamine
NAM	N-acetylmuramic acid
NCBI	National Center for Biotechnology Information

PBP2a	Penicillin-binding protein 2a
PCR	Polymerase chain reaction
SCCmec	staphylococcal cassette chromosome mec

1.Introduction

INTRODUCTION

The emergence of antibiotic resistant bacteria in both animals and humans requires urgent attention **(Davies and Davies, 2010)**. The problem arises when antibiotic resistant pathogens and/or their resistance genes transfer from animals to humans leading to serious public health concerns. These concerns include infections that are difficult to treat and are associated with high mortality rates, extended hospital stays, and increased treatment costs **(Huijbers et al., 2015)**. Adding to this, antibiotic resistance genes are not limited to harmful pathogens but are also present among human and animal commensal bacteria, and bacteria present naturally in the environment (**Laube et al., 2014; Blaak et al., 2015).** Thus, limiting the spread of antibiotic resistance genes is very crucial, and requires an approach that takes into account transmission between humans, between animals, between animals and humans, and the role of the environment in these processes **(Founou et al., 2016)**

In particular, veterinary environments are long regarded as epidemic areas for multidrug-resistant (MDR) pathogens **(Sanchez et al., 2002)**. Though the length and quality of diseased animals lives have been enhanced thanks to veterinary medical and technical improvements which are notably seen during long-term hospitalization, surgical implants, treating geriatric and chronically ill or immune-deficient animals with antibiotics **(Wieler et al., 2015),** multidrug-resistant pathogens can be a real danger not only to hospitalized animals patients but also to the animal owners and veterinary personnel **(Walther et al., 2014)** as these pathogens were considered transmissible between animals and humans (**Wieler et al., 2015**).