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Comparison between *Staphylococcus aureus* of animals origin and that of human origin

A thesis presented by

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Abstract

The main objective of the present study was to compare between *Staphylococcus aureus* isolated from animal and human origin, where phenotypic, virulence and genotypic analysis were investigated. A total number of 165 samples was collected from clinical mastitic cows' and sheep's, pus from abscesses and septic wounds of infected animals, also, blood, pus swabs from abscesses and septic wounds and sputum where collected from diseased human admitted to clinics of Assiut Governorate, Egypt. The results revealed that, incidence of *S. aureus* isolated from positive *Staphylococcus* spp. among the examined animal samples, where clinical mastitic cows', clinical mastitic sheep's and pus samples of examined animals were 8.33%, 100% and 20%, respectively, while from blood, pus and sputum of human cases were 16.67%, 53.49% and 75%, respectively. Also, the prevalence of coagulase positive *S. aureus* reached 8.33%, 100% and 20%, respectively, from clinical mastitic cows', clinical mastitic sheep's and pus samples of examined animals, but from blood, pus and sputum of diseased human were 16.67%, 53.49% and 75%, respectively, using Staphaurex kits. The results of antimicrobial sensitivity test of the recovered *S. aureus* strains from animal samples explained that, most of them were highly resistant to cefoxitin and tetracycline with a percentage of 15.79% (for each) and clindamycin and erythromycin with a percentage of 10.53% (for each). However, *S. aureus* strains from human cases were resistant to cefoxitin (75%) and tetracycline (78.57%). Moreover, *S. aureus* from animal cases was sensitive to gentamicin (100%), trimethoprim+sulfamethoxazole and vancomycin (94.74% for each), but in human cases recovered *S. aureus* strains were sensitive to vancomycin (100%), ciprofloxacin (89.29%) and trimethoprim+sulfamethoxazole (82.14%). Out of 47 identified *S. aureus* strains 3(15.79%) and 21(75%), respectively, from animal and human samples proved to be methicillin resistant (MRSA). Also, 1(5.26%) of animal samples and 12(42.86%) of human samples were multi-drug resistant (MDR). Genotypic detection of *mecA* gene was carried out using specific primers at polymerase chain reaction technique (PCR). The obtained results cleared that, 6 of *S. aureus* strains from animal and human origin were positive for *mecA* gene with a percentage of 100% (for each). The main goal of the present study was the comparative similarity between *mecA* gene sequences from animal and human strains using the BLAST analysis and phylogenetic tree of DNA sequencing, where *S. aureus* represent a major serious implications on public health.

Keywords: (*S. aureus*/ clinical mastitis/ cows/ sheep/ human/ MRSA/ MDR/ PCR/ DNA sequencing).

CONTENTS

List of Tables

List of Figures

List of Abbreviations

agr	accessory gene regulator
AUH	Assiut University Hospital
bbp	Branchpoint-bridging protein
BHI	Brain heart infusion
BLAST	Basic Local Alignment Search Tool
bp	base pair
CA-MRSA	Community-acquired methicillin resistant *Staphylococcus aureus*
CA	Community-acquired
CC	Clonal Complex
CDS	Coding DNA sequence
***cfl*A**	Clumping factor A
***cfl*B**	Clumping factor B
CIP	Ciprofloxacin.
CN	Gentamicin
Coa	Coagulase gene
CoNS	Coagulase-negative staphylococci
CP	Capsular polysaccharide
CoPS	Coagulase positive *S. aureus*
CTAB	Cetyl trimethyl ammonium bromide
DA	Clindamycin

D-Ala-D-Lac	D-Alanyl-D-Lactate
DNA	Deoxyribonucleic acid
DNase	Deoxyribonuclease
dNTP	Deoxynucleotide triphosphates
E	Erythromycin
ebps	Elastin-binding protein
EDTA	Ethylene diamine tetra-acetic acid
EFT	Exofoliation toxin
eno	enolase
FBD	Foodborne disease
femA	Factor essential for expression of methicillin resistance A
fib	fibrinogen-binding
***fnb*A**	fibronectin-binding protein A
***fnb*B**	fibronectin-binding protein B
FOX	Cefoxitin
HA	Hospital acquired
HA-MRSA	Hospital-acquired methicillin-resistant *S. aureus*
HCL	Hydrogen chloride
hla	alpha-hemolysin (α-toxin) gene
hlb	Beta-hemolysin (β-toxin) gene
H_2O_2	Hydorogen peroxide
HUM1	Human1 Egyptian isolates
***ica*A**	intercellular adhesion A gene

***ica*B**	intercellular adhesion B gene
***ica*C**	intercellular adhesion C gene
***ica*D**	intercellular adhesion D gene
iLDH	inducible lactate dehydrogenase
LA-MRSA	Livestock associated methicillin-resistant *S. aureus*
luk F	Leukocidin F
luk S	Leukocidin S
MDR	Multi-drug resistant
mecA	Methicillin resistance A gene.
MEGA 5.0	Molecular Evolutionary Genetics Analysis 5.0
MegAlign	Software for Multiple Sequence Alignments
MGE	mobile genetic elements
MIC	Minimum inhibitory concentration
MLST	Multi-locus sequence typing
MRCoNS	Methicillin resistant coagulase negative staphylococci
MRSA	Methicillin-resistant *Staphylococcus aureus*
MSA	Mannitol salt agar
MSCRAMMs	Microbial surface components recognizing adhesive matrix molecules.
MSSA	Methicillin-susceptible *Staphylococcus aureus*
Nacl	Sodium chloride
NaoH	Sodium hydroxide
NCBI	National Center for Biotechnology Information
No.	Number of positive
nuc	thermonuclease gene
O_2	Oxygen

PABA	Para-amino benzoic acid
PBP-2'	Penicillin-binding protein 2'
PBP2a	Penicillin-binding protein 2a
PBPs	Penicillin-binding proteins
PCR	Polymerase Chain Reaction
PFGE	Pulsed-field gel electrophoresis
PRL	Prolactin hormon
PTs	Pyrogenic toxins.
PVL	Panton-Valentine leukocidin
RNAIII	Ribonucleic acid III
SAE	Superantigen enterotoxin
SCC*mec*	Staphylococcal cassette chromosome *mec*
SDS	Sodium dodecyl sulfate
SEA	Staphylococcal enterotoxin A
SEB	Staphylococcal enterotoxin B
SEC	Staphylococcal enterotoxin C
SED	Staphylococcal enterotoxin D
SEG	Staphylococcal enterotoxin G
SEH	Staphylococcal enterotoxin H
SEM	Scanning electron micrograph
SEs	Staphylococcal enterotoxins.
SFP	Staphylococcal food poisoning
SMZ-TMP	Sulfamethoxazole and trimethoprim
SODs	Superoxide dismutases
spa	*Staphylococcus* protein A gene

spp.	Species
SSSS	Staphylococcal Scalded Skin Syndrome.
ST	Sequence type
SSTIs	Skin and soft tissue infections
TAB	Hexadecyltrimethyl ammonium bromide
TBE	Tris/Borate/ Ethylene diamine tetra-acetic acid
TCT	Tube coagulase test
TE	Tetracycline
TNase	Thermonuclease
TSA	Tryptase soy agar
TSB	Tryptic soy broth
TSST-1	Toxic shock syndrome toxin-1
UV	Ultra-Violet ray
VA	Vancomycin
Van A	Vancomycin A resistance gene
VET1	Veterinary1 Egyptian isolates
VRSA	Vancomycin resistant *S. aureus*
WHO	World Health Organization