



UNIVERSITI PUTRA MALAYSIA

**PREVALENCE OF *Staphylococcus aureus* NASAL CARRIERS AMONG
FOOD HANDLERS AND IN SELECTED FOOD AND ITS ASSOCIATION
WITH KNOWLEDGE, ATTITUDE AND PRACTICE**

NOOR AZIRA BINTI ABDUL MUTALIB

FPSK(m) 2011 25

PREVALENCE OF *Staphylococcus aureus* NASAL CARRIERS AMONG FOOD HANDLERS AND IN SELECTED FOOD AND ITS ASSOCIATION WITH KNOWLEDGE, ATTITUDE AND PRACTICE

By

NOOR AZIRA BINTI ABDUL MUTALIB

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfillment of the Requirements for the Degree of Master of Science**

December 2011

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science.

PREVALENCE OF *Staphylococcus aureus* NASAL CARRIERS AMONG FOOD HANDLERS AND IN SELECTED FOOD AND ITS ASSOCIATION WITH KNOWLEDGE, ATTITUDE AND PRACTICE

NOOR AZIRA BT ABDUL MUTALIB

December 2011

Chairman : Malina binti Osman, MD

Faculty : Faculty of Medicine and Health Sciences

The outbreak of food poisoning due to *Staphylococcus aureus* has been reported with a significant level of morbidity worldwide. The outbreaks occur due to lack of proper food handling practices by the food handling personnel. In this study, the prevalence of *S. aureus* nasal carriage as well as their knowledge, attitude and practice (KAP) were determined among food handlers and its association with the gender, age, work duration, educational level and food premises. 128 samples taken from nasal swabs of 64 food handlers' and 64 food items were collected and analyzed. Furthermore during the collection of samples, questionnaire regarding KAP on food hygiene and sanitation were also distributed among the food handlers. The isolates were identified as *S. aureus* based on colonial morphology, Gram stain, mannitol salt agar fermentation, catalase and

coagulase test. Antibiotic susceptibility profiles of the isolates were also done in order to study the resistance pattern of the isolates. Twenty three percent of food handlers were found to be positive for *S. aureus* nasal carriage and 37.5% of the food samples were contaminated with an average of 8.4×10^6 CFU/g. None of the isolates was resistant to oxacillin and mupirocin but most of the isolates (74.4%) were resistant to penicillin. Only 15.4% and 5.1% of the isolates were resistant to tetracycline and erythromycin, respectively. In addition, seven antibiotic profiles were determined from the antibiotic susceptibility test. The mean score (SD) of the food handlers' knowledge, attitude and practice were 83.98% (13.26), 82.8% (10.94) and 77.04% (14.98) respectively. Premise grades C proves to be a significant predictor for food handlers knowledge [OR 21.0, (95% CI = 3.522-125.219, *P* value = 0.001)]. In addition, knowledge on food hygiene and sanitation showed a significant association with attitude [OR 10.0, (95% CI = 1.988-50.291, *P* value = 0.005)]. The result for attitude section also showed that food handlers with diploma proves to be a significant predictor for attitude [OR 7.9, (95% CI = 1.890-32.905, *P* value = 0.005)]. Moreover, knowledge on food hygiene and sanitation showed a significant association with practice [OR 18.3, (95% CI = 1.440-23.408, *P* value = 0.005)]. However sociodemographic characteristics and food handlers' KAP have no significant association with food handlers carrier status. The result shows that even though the KAP level of food handlers were excellent, more than 20% of them were *S. aureus* nasal carriers and the number of contaminated food was also high. Thus, improvement in hygiene and sanitation is needed.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains.

**PREVALENS *Staphylococcus aureus* PEMBAWA DALAM HIDUNG
DIKALANGAN PENGENDALI MAKANAN DAN MAKANAN TERPILIH
SERTA PERKAITANNYA DENGAN PENGETAHUAN, SIKAP DAN AMALAN**

NOOR AZIRA BT ABDUL MUTALIB

Disember 2011

Pengerusi : Malina binti Osman, MD

Fakulti : Fakulti Perubatan dan Sains Kesihatan

Kes keracunan makanan yang disebabkan oleh *Staphylococcus aureus* telah dilaporkan secara signifikan di seluruh dunia. Kebanyakan kes-kes tersebut berlaku disebabkan kurangnya nilai kebersihan dikalangan pengendali makanan. Dalam kajian yang dijalankan, prevalens *S. aureus* bawaan hidung serta tahap pengetahuan, sikap dan amalan pengendali makanan, dan hubungannya dengan jantina, umur, tempoh pekerjaan, tahap pembelajaran, gred premis makanan telah ditentukan. 128 sampel telah diambil daripada rongga hidung 64 orang pengendali makanan dan 64 jenis makanan serta dianalisis. Semasa pengambilan sampel dijalankan, responden-responden diminta untuk menjawab soal selidik berkaitan dengan pengetahuan, sikap dan amalan berkaitan dengan kebersihan dan sanitasi makanan. Isolat-isolat dikenal pasti sebagai *S. aureus*

berdasarkan morfologi coloni, perwarnaan Gram, fermentasi agar garam manitol, ujian enzim 'catalase' dan 'coagulase'. Profil kerintangan isolat-isolat terhadap antibiotik telah ditentukan. 23.4% pengendali makanan didapati positif sebagai pembawa *S. aureus* dalam hidung dan 37.5% sampel makanan telah dicemari dengan purata sebanyak 8.4×10^6 cfu/g. Tiada isolat yang didapati mempunyai kerintangan terhadap antibiotik oxacillin dan mupirosin tetapi kebanyakan isolat (74.4%) mempunyai kerintangan terhadap antibiotik penicillin. 15.4% dan 5.1% daripada isolat-isolat tersebut masing-masing mempunyai kerintangan terhadap antibiotik tetrasiklin dan eritromisin. Sebagai tambahan, terdapat tujuh profil antibiotik yang diperolehi melalui ujian kerintangan terhadap antibiotik dengan enam isolat yang mempunyai kerintangan berbilang kerana rintang terhadap dua antibiotik yang diuji. Purata markah (sisihan piawai) pengetahuan, sikap dan amalan pengendali makanan adalah masing-masing 83.98% (13.26), 82.8% (10.94) and 77.04% (14.98). Gred premis C menunjukkan hubungan yang signifikan dengan tahap pengetahuan [OR 10.0, (95% CI = 1.988-50.291, P value = 0.005)]. Terdapat hubungan yang signifikan diantara pengendali makanan yang mempunyai diploma dengan tahap sikap [OR 7.9, (95% CI = 1.890-32.905, P value = 0.005)]. Tahap pengetahuan dalam kebersihan dan sanitasi makanan juga menunjukkan hubungan yang signifikan dengan amalan [OR 18.3, (95% CI = 1.440-23.408, P value = 0.005)]. Kajian menunjukkan bahawa walaupun tahap pengetahuan, sikap dan amalan pengendali makanan adalah cemerlang lebih 20% daripada mereka merupakan pembawa *S. aureus* dalam hidung dan bilangan makanan tercemar adalah tinggi. Maka, peningkatan tahap kebersihan dan sanitasi adalah penting.

ACKNOWLEDGEMENTS

Bismillahirrahmanirrahim

Alhamdulillah. Firstly I would like to thank Allah Almighty for His blessing and the opportunity that has been given to me to learn and gain precious experience during this study. I would also like to express my deepest appreciation to my supervisor, Dr. Malina Osman for her guidance and support as well as the time spent for discussion throughout this research and thesis writing. Thousands gratitude is also conveyed to my co-supervisors, Dr. Syafinaz Amin Nordin and Associate Professor Dr. Shuhaimi Mustafa for their advice and assistance in this study. I would also want to thank my husband, my daughter, my family and my friends for giving me the strength to step forward and cross the finishing line. I would like to thank all staff members in Medical Microbiology and Parasitology laboratory for their assistance as well as the staff members in Kuala Pilah district health office for their support and guidance in helping me to collect the food and nasal swab samples. Last but not least, I want to thank Ministry of Higher Education for the scholarship that has been supporting me for the past two years.

I certify that a Thesis Examination Committee has met on (**6 December 2011**) to conduct the final examination of Noor Azira Abdul Mutalib on her thesis entitled “**Prevalence of *Staphylococcus aureus* nasal carriers among food handlers and in selected foods and its association with knowledge, attitude and practice**” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

Shamsul Bahri Hj Mohd Tamrin, PhD

Lecturer
Faculty of Medicine and Health Sciences
University Putra Malaysia
(Chairman)

Farida Fatema @ Farida Jamal, PhD

Professor
Faculty of Medicine and Health Sciences
University Putra Malaysia
(Internal Examiner)

Anita Abdul Rahman, PhD

Lecturer
Faculty of Medicine and Health Sciences
University Putra Malaysia
(Internal Examiner)

Norsa'adah Bachok, PhD

Associate Professor
Unit of Biostatistics and Research Methodology
School of Medical Sciences
Universiti Sains Malaysia
Malaysia
(External Examiner)

PROF. DR. SEOW HENG FONG, PhD
Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for degree of Master of Science. The members of Supervisory Committee were as follows:

Malina Osman, MD

Senior Medical Lecturer
Faculty of Medicine and Health Sciences
University Putra Malaysia
(Chairman)

Syafinaz Amin Nordin, MPath

Senior Medical Lecturer
Faculty of Medicine and Health Sciences
University Putra Malaysia
(Member)

Shuhaimi Mustafa, PhD

Associate Professor
Faculty of Biotechnology and Biomolecular Sciences
University Putra Malaysia
(Member)

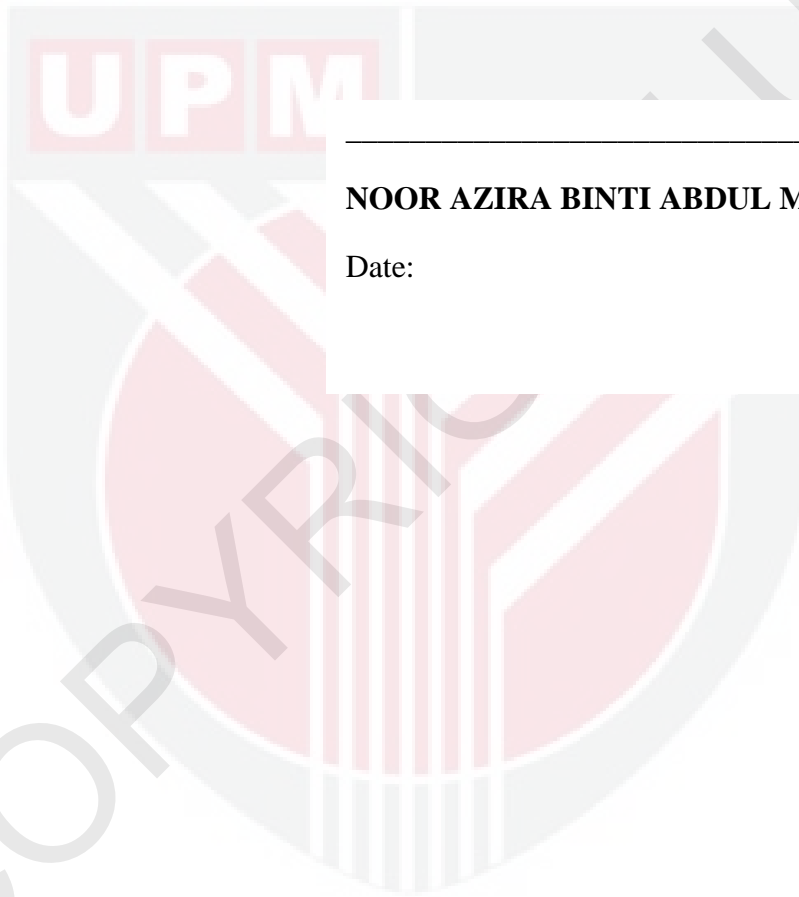
BUJANG BIN KIM HUAT, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



NOOR AZIRA BINTI ABDUL MUTALIB

Date:



TABLE OF CONTENTS

ABSTRACT	Page
ABSTRAK	ii
ACKNOWLEDGEMENTS	iv
APPROVAL	vi
DECLARATION	vii
LIST OF TABLES	ix
LIST OF FIGURES	xiv
LIST OF ABBREVIATIONS	xvi
	xvii

CHAPTER

1.	INTRODUCTION	1
	1.1 Preface	1
	1.2 Food poisoning cases in Malaysia	2
	1.3 Food Poisoning	4
	1.4 Problem statement and significant of study	5
	1.5 Research objectives	6
	1.6 Hypotheses	7
	1.7 Research Framework	7
2.	LITERATURE REVIEW	9
	2.1 Food Hygiene	9
	2.2 Sanitization of kitchen utensils	11
	2.2.1 Physical factors that influence sanitization process	12
	2.2.2 Chemical factors that influence sanitization process	13
	2.2.3 Biological factors that influence sanitization process	14
	2.3 Safe food handling at home	14
	2.3.1 Prewashing of food items	15
	2.3.2 Utensils as media for cross contamination	15
	2.3.3 Storage and handling of food items	16
	2.4 Primary sources of microorganisms found in food	18
	2.5 Intrinsic parameters of foods that affect microbial growth	20
	2.5.1 pH	20
	2.5.2 Moisture content.	20
	2.5.3 Nutrient content.	21
	2.5.4 Antimicrobial constituents.	22
	2.5.5 Biological structures.	22
	2.6 Extrinsic Parameters of Foods that Affect Microbial Growth	23
	2.6.1 Temperature of storage.	23

2.6.2	Relative humidity (RH) of the environment.	23
2.6.3	Presence and concentration of gases in the environment.	24
2.7	Handling food items	24
2.7.1	Handling raw meats	24
2.7.2	Handling eggs	27
2.7.3	Handling seafood	29
2.8	Foodborne diseases	32
2.9	Food poisoning	34
2.10	<i>Staphylococcus aureus</i> and staphylococcal food poisoning	38
2.11	Nasal carriers' state	41
2.12	Food handlers as sources of contamination	41
2.13	Knowledge, attitude and practice	44
2.14	Hazards Analysis and Critical Control Point (HACCP)	46
3.	MATERIALS AND METHOD	49
3.1	Study design	49
3.2	Study location	49
3.3	Duration of the study	49
3.4	Study population	49
3.5	Sampling frame	49
3.6	Sampling unit	50
3.7	Sampling method	50
3.8	Sample size	50
3.9	Inclusion criteria for food handlers	51
3.10	Exclusion criteria for food handlers	51
3.11	Inclusion criteria for food samples	51
3.12	Exclusion criteria for food samples	52
3.13	Variables	52
3.14	Ethical Issue and Consent	52
3.15	Instruments	53
3.16	Procedures	53
3.16.1	Sampling for nasal swab	53
3.16.2	Food sampling	53
3.16.3	Isolation of <i>Staphylococcus aureus</i> from nasal swab and food	55
3.16.4	Gram staining for morphological observation of the isolates	55
3.16.5	Determination of catalase production	55
3.16.6	Determination of coagulase production	56
3.16.7	Antibiotic susceptibility test	56
3.16.8	Preparation of stock culture	56
3.16.9	Strains for positive and negative control	57

3.17	Questionnaire	57
3.17.1	Food handlers' sociodemographic characteristics	57
3.17.2	Knowledge in food hygiene and sanitation	58
3.17.3	Attitude towards food hygiene and sanitation	58
3.17.4	Practice towards food hygiene and sanitation	59
3.18	Validity and Reliability of the Instruments	59
3.19	Pre-testing the questionnaire	60
3.20	Questionnaire distribution	60
3.21	Statistical analysis	60
4.	RESULT	62
4.1	Sociodemographic Characteristics of the respondents	62
4.2	Colonization on food handlers and food contamination.	65
4.3	Antibiotic susceptibility test	65
4.4	Food handlers 'knowledge, attitude and practice	68
4.4.1	Food handlers' knowledge on food hygiene and sanitation	68
4.4.2	Food handlers' attitude towards food hygiene and sanitation	69
4.4.3	Food handlers' practices towards food hygiene and sanitation	70
4.5	Association between food handlers' KAP and sociodemographic characteristics	72
4.5.1	Association between food handlers' knowledge and their sociodemographic characteristics	72
4.5.2	Association between food handlers' attitude and their sociodemographic characteristics	74
4.5.3	Association between food handlers' practice and their sociodemographic characteristics	76
4.5.4	Association between food handlers' S. aureus nasal carriers and their sociodemographic characteristics	78
4.6	Strength of association between food handlers' KAP and sociodemographic characteristics	80
5	DISCUSSION	82
5.1	Colonization on food handlers and food contamination.	82
5.2	Antibiotic susceptibility test	84
5.3	Food handlers' knowledge, attitude and practice	87
5.3.1	Food handlers' knowledge on food hygiene and sanitation	87
5.3.2	Food handlers' attitude towards food hygiene and sanitation	88
5.3.3	Food handlers' practices towards food hygiene and sanitation	90

5.4	Association between food handlers' KAP and sociodemographic characteristics	91
5.5	<i>S. aureus</i> nasal carriers	95
6	SUMMARY, CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH	98
6.1	Summary and conclusion	98
6.2	Recommendation	101
6.3	Recommendations for future research	102
6.4	Limitations of study	103
	REFERENCES	105
	APPENDICES	123
	BIODATA OF STUDENT	141
	LIST OF PUBLICATIONS	142