

# **DETECTION OF ANTIBIOTIC RESISTANT *PROPIONIBACTERIUM ACNES* ISOLATED FROM PATIENTS WITH ACNE VULGARIS**

Thesis Submitted for Partial Fulfillment of M.Sc. Degree in  
Medical Microbiology and Immunology

By

**Rasha Anter Metwally Elfekki**

(M.B.B.Ch., Cairo University)

**Supervisors**

**Prof. Dr. Nadia Hafez Salah El-Din Ouda**

Professor of Medical Microbiology & Immunology

Faculty of Medicine – Cairo University

**Ass. Prof. Dr. Nesrine Samir Abdelfatah**

Assistant Professor of Dermatology

Faculty of Medicine – Cairo University

**Dr. Manal Mohammed Sulaiman Hallal**

Lecturer of Medical Microbiology & Immunology

Faculty of Medicine – Cairo University

**Faculty of Medicine**

**Cairo University**

**2016**

# الكشف عن بروبونيبيكتريا حب الشباب المقاومة للمضادات الحيوية والمعزولة من المرضى الذين يعانون من حب الشباب

رسالة مقدمة توطئة للحصول على درجة الماجستير  
فى الميكروبيولوجيا الطبية والمناعة

من الطيبة  
**رشا عنتر متولى الفقى**  
(بكالوريوس الطب والجراحة – جامعة الزقازيق)

تحت إشراف

**الأستاذة الدكتورة/ نادية حافظ صلاح الدين عودة**  
أستاذ الميكروبيولوجيا الطبية والمناعة  
كلية الطب – جامعة القاهرة

**الدكتورة/ نسرين سمير عبد الفتاح**  
أستاذ مساعد الامراض الجلدية  
كلية الطب – جامعة القاهرة

**الدكتورة/ منال محمد سليمان حلال**  
مدرس الميكروبيولوجيا الطبية والمناعة  
كلية الطب – جامعة القاهرة

كلية الطب  
جامعة القاهرة

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## **ACKNOWLEDGEMENT**

***“First and Foremost, Thanks to Allah,  
The Beneficent and Merciful of all”***

*No words could express my sincere thanks, deepest gratitude and respect to **Prof. Dr. Nadia Hafez Ouda**, Professor of Medical Microbiology and Immunology, Faculty of Medicine, Cairo University, for her generous support and overwhelming kindness. Her precious guidance and continued assistance are beyond this acknowledgment.*

*My heartfelt thanks and deep appreciation must go to **Dr. Manal Mohammed Sulaiman Hallal**, Lecturer of Medical Microbiology and Immunology, Faculty of Medicine, Cairo University, for her kind advice and guidance in fulfilling this work. I am greatly indebted to her for her valuable remarks and endless cooperation.*

*I had the honour to proceed in the present work under the supervision of **Dr. Nesrine Samir Abdelfattah**, Assistant Professor of Dermatology, Faculty of Medicine, Cairo University. I am greatly indebted to her for her active cooperation during the practical part of the study.*

*I am greatly indebted to **Dr. Asmaa Said Hegab**, Lecturer of Medical Microbiology and Immunology, Faculty of Medicine, Cairo University, for her valuable advice, expert guidance and active cooperation especially during the practical part of the study.*

*To all my respectable Professors and staff members at the Department of Medical Microbiology and Immunology, Faculty of Medicine, Cairo University, I am deeply grateful. Special and sincere thanks must go to them.*

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*My great appreciation must go to all the staff members of the different Dermatology outpatient clinics in Kasr Al-Ainy Hospital, for facilitating sample collection.*

*Finally, I would like to deeply thank my whole family especially my loving husband for his patience and continuous support throughout this thesis.*

## ABSTRACT

*Propionibacterium acnes* (*P. acnes*) has been implicated in the pathogenesis of acne since the beginning of the last century. Over several decades, topical and systemic antibiotics have been the main line of treatment for acne vulgaris. However, in the present era of increased antibiotic usage, resistant strains have emerged. The aim of this study is to determine the antibiotic resistance pattern among *P. acnes* isolated from patients with acne vulgaris at the Dermatology clinics of Kasr Al-Ainy Teaching Hospital. Specimens were extracted from the pustules and taken by sterile cotton swabs and transported by thioglycolate media. Each swab was inoculated onto two blood agar plates, one incubated aerobically at 37°C for 24h and the other anaerobically for one week. *P. acnes* was identified by Gram stain and biochemical tests. Their susceptibility pattern to doxycycline, erythromycin, clindamycin, tetracycline, azithromycin and trimethoprim-sulfamethoxazole was determined on Muller Hinton media by disc diffusion method. A total of 44 *P. acnes* isolates were identified from 100 patients with acne vulgaris, out of which 22.7% were resistant to clindamycin, 11.4% were resistant to trimethoprim-sulfamethoxazole and 9% were resistant to erythromycin. Resistance to doxycycline, tetracycline or azithromycin was not detected. Trimethoprim-sulfamethoxazole showed statistically significant difference in the resistance pattern compared to patient's sex ( $p = 0.029$ ) and to receiving previous treatment ( $p = 0.018$ ). In conclusion, *P. acnes* was prevalent in patients with acne vulgaris (44%) and resistant isolates are detected especially in those who have received previous therapy (more than two weeks) (68%). It is recommended that dermatologists and family physicians follow the guidelines for proper management of acne, with the judicious use of antibiotics, in order to prevent antibiotic resistance.

**Key words:** *Propionibacterium acnes*, acne vulgaris, antibiotic resistance, clindamycin, erythromycin, trimethoprim-sulfamethoxazole, doxycycline, azithromycin.

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## LIST OF ABBREVIATIONS

ACPs	Antimicrobial cationic peptides
AMPs	Antimicrobial peptides
ARA	Antibiotic-resistant acne
AzA	Azelaic acid
AZM	Azithromycin
BPO	Benzoyl peroxide
CONS	Coagulase-negative staphylococci
CRH	Corticotropin-releasing hormone
DA	Clindamycin
DHEA-S	Dehydroepiandrosterone-sulphate
DO	Doxycycline
E	Erythromycin
HBD2	Human B-Defensin2
HLA-DR	Human Leucocyte Antigen-DR
HOBR	Hypobromous acid
ICAM	Intracellular adhesion molecule
LOX	Lipoxygenase

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MLS	Macrolides-Lincosamides-Streptogramins
MMP	Matrix metalloproteinase
NCCLS	National Committee for Clinical Laboratory Standards
PAR	Protease-activated receptor
<i>P. acnes</i>	<i>Propionibacterium acnes</i>
<i>P. acidipropionici</i>	<i>Propionibacterium acidipropionici</i>
<i>P. avidum</i>	<i>Propionibacterium avidum</i>
<i>P. cyclohexanicum</i>	<i>Propionibacterium cyclohexanicum</i>
<i>P. freudenreichii</i>	<i>Propionibacterium freudenreichii</i>
<i>P. granulosum</i>	<i>Propionibacterium granulosum</i>
<i>P. jensenii</i>	<i>Propionibacterium jensenii</i>
<i>P. lymphophilum</i>	<i>Propionibacterium lymphophilum</i>
<i>P. propionicum</i>	<i>Propionibacterium propionicum</i>
<i>P. thoenii</i>	<i>Propionibacterium thoenii</i>
<i>p</i> value	Probability value
ROS	Reactive oxygen species
<i>S. aureus</i>	<i>Staphylococcus aureus</i>
<i>S. epidermidis</i>	<i>Staphylococcus epidermidis</i>

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SXT	Trimethoprim-sulphamethoxazole
TB	Taurine bromine
TE	Tetracycline
TLR	Toll-like receptors
VCAM-1	Vascular cell adhesion molecule-1

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# INTRODUCTION

Acne is a disease of the pilosebaceous unit of hair follicles in the skin that are associated with an oil gland (*Jacob et al., 2001*). The clinical features of acne include seborrhoea (excess grease), non-inflammatory lesions (open and closed comedones), inflammatory lesions (papules and pustules) and various degrees of scarring. The distribution of acne corresponds to the highest density of pilosebaceous units (face, neck, upper chest, shoulders and back) (*van Zuuren et al., 2007*).

Globally, acne is a common skin disorder affecting the majority of adolescents. Although acne typically starts in puberty, it often persists into adulthood (*Collier et al., 2008*). It is associated with marked physical and psychological morbidity, and significantly affects the quality of life of people with the disease (*Barnes et al., 2012*).

*Propionibacterium acnes* (*P. acnes*) is a Gram-positive, anaerobic rod that is a major colonizer and inhabitant of the human skin along with *Staphylococcus*, *Corynebacterium*, *Streptococcus* and *Pseudomonas* spp. Although often defined as a commensal, *P. acnes* is infrequently associated with invasive infections of the skin, soft tissue, cardiovascular system or deep-organ tissues and is an important opportunistic pathogen causing implant-associated infections (*Cogen et al., 2008*). A connection between acne vulgaris and *P. acnes* has long been suggested. Collected samples have been processed following various methodologies ranging from culture studies to probe labeling and molecular analysis. Direct visualization techniques have shown the existence of anatomically distinct skin *P. acnes* populations: epidermal and follicular. Moreover, *P. acnes* biofilms appear to be a common phenomenon. Current sampling

approaches target different skin populations of *P. acnes* and the presence of microbial biofilms can influence its retrieval (*Alexeyev and Jahns, 2012*).

A variety of treatment options have been developed for acne and are tailored to the severity and persistence of the disease. Over the last few decades, clinical trials have been conducted to evaluate the efficacy and safety of such interventions, making acne therapy a highly studied area in dermatology (*Zarchi and Jemec, 2012*).

Topical antibiotics may be used to treat mild to moderate acne. Systemic antibiotics are indicated when acne is moderate to severe or if disease manifestations are producing marked psychosocial stress for patients (*Tan and Tan, 2005*). Various classes of antibiotics, such as sulfonamides, macrolides, tetracyclines and dapsone, may be used to treat acne. The purpose of this treatment modality is to decrease the presence of *P. acnes* on the skin surface and within the pilosebaceous unit (*Leyden et al., 2009*).

Widespread and long-term use of antibiotics has led to the development of *P. acnes* resistance (*Leyden et al., 2007*). The increasing prevalence of antimicrobial resistance in *P. acnes* poses a significant challenge to successful treatment outcomes in acne patients (*Mendoza et al., 2013*).

## **AIM OF WORK**

The aim of this study is to:

- Identify *Propionibacterium acnes* isolated from patients with acne vulgaris attending the outpatient Dermatology clinics of Kasr Al-Ainy Teaching Hospital, Cairo University.
- Determine the resistance pattern of *Propionibacterium acnes* isolates.

# ACNE VULGARIS

Acne vulgaris is a chronic inflammatory disorder of the pilosebaceous follicles. It is a multifactorial, pleomorphic skin disease characterized by a variety of non-inflamed (open and closed comedones) and inflamed (macules, papules, pustules and nodules) lesions (*Shaheen and Gonzalez, 2013*).

## EPIDEMIOLOGY

Acne is most common in adolescents, affecting approximately 85% of teenagers and its prevalence decreases with increasing age. However, the disease burden in younger adults is quite high (*Collier et al., 2008*). A common misconception is that acne is a self-limited teenage disease and thus, does not warrant attention as a chronic disease (*Gollnick et al., 2008 & Uhlenhake et al., 2010*).

The average age of onset of acne is 11 years in girls and 12 years in boys (*Dreno and Poli, 2003*). Acne is increasing in children of younger ages, with the appearance of acne in patients as young as 8 or 9 years of age. This trend toward earlier development of acne is thought to be related to the decreasing age-of-onset of puberty (*Goldberg et al., 2011*).

Acne is more common in males in adolescence and early adulthood however, adult acne is more common in women. Adult acne typically represents chronic acne that had persisted from adolescence and not a new-onset disease (*Friedlander et al., 2010*).