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Investigation of novel antimicrobial agents extracted from plant materials for the treatment of wounds infection

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Approval sheet

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This dissertation has not been previously submitted for any degree at this or at any other university

Lamia Ibrahim Moursy Ismail

ABSTRACT

This study was performed in the National cancer institute between 19/11/2008 to 30/5/2010 where 103 surgeries were analyzed. Twenty two species of bacterial cultures belonging to 8 genera were obtained from infected wound cultures. The most common was ***E.coli*** which represent 17.5% this was followed by ***A. baumannii*** 14.5%, come next in rank both of ***Achromobacter sp.*** and ***P. aeruginosa*** each represent 13.6% and 12.6% respectively. Data also showed the occurrence of ***S. aureus, E. aerogenes*** and ***K. pneumoniae*** representing 11.6%, 4.8% and 5.8% respectively. The lowest occurrence was recorded by ***Morganella morganii*** that represented 2.9%. While the other isolated species were of low occurrence frequency. Measurement of C-reactive protein (CRP) and interleukin-6 (IL-6) in the blood of tested patients was high indicting that all patients were suffering from inflammation. The 8 most potent isolates were found to be resistant to the most 41 tested antibiotics, while they showed variable sensitivity to the tested plant extracts. Methanol extract of cinnamon, guava, sumac and radish and ether extract of cloves were found to be the most effective plant extracts against the tested pathogenic bacterial isolates. Analysis of the five selected plant extracts revealed that they contain tannins, sterols and terpenes, resins, flavonoids (combined and free), saponins,

glycosides, alkaloids and phenolic compounds. Our GC/MS analysis of cinnamon oil identified twenty-six phytochemicals as constituents; of these cinnamaldehyde was the major compound (57.6%) followed by Cinnamyl acetate (9.22%), Eugenol (5.070%) ,Cinnamaldehyde dimethyl Acetal (3.5%) and Vitamin E (2.3%).

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ABBREVIATIONS

WBC	white blood cell
C3a	activated complement product
IL-6	interleukin 6
CRP	C-reactive protein
i.e.	that is
ESBL	Extended-Spectrum Beta-Lactamase
SSI	surgical site infections
CFU	colony-forming units
SIRS	systemic inflammatory response syndrome
CoNS	Coagulase-negative staphylococci
NINSS	Nosocomial infection national surveillance service
NICU	neonatal intensive care unit
ICUs	intensive care units
ELISA	enzyme linked Immune sorbent assay
v/v	volume/volume
Da	Dalton (the Atomic mass unit)
Tibia	shinbone or shankbone
AML	Acute myeloid leukemia
NHL	non-Hodgkin lymphomas
T-ALL	T-cell acute lymphoblastic leukemia
AIDS	Acquired immunodeficiency syndrome
HIV	Human immunodeficiency virus

INTRODUCTION

Skin and soft-tissue infections are among the most common infections, and may lead to serious local and systemic complications. These infections can be potentially life-threatening and may progress rapidly; therefore, their early recognition and proper medical and surgical management is important **(Brook, 1995)**. The pathogenesis of infections usually involves direct inoculation of pathogens, but infection occasionally spreads to the skin contiguously from deeper foci or haematogenously from distant sites **(Francque *et al.*, 2001; Lodha *et al.*, 2003; Mahler *et al.*, 2003)** .

Severity ranges from minor superficial lesions to invasive, fulminant and even lethal infections. The most common pathogens are aerobic Gram positive cocci, but complicated infections frequently involve Gram-negative bacilli and anaerobic bacteria. Initial antibiotic therapy is usually empirical, and later modified by the results of stains and cultures of wound specimens. Broad-spectrum coverage is frequently needed for complicated infections **(Mark *et al.*, 2004)**.

The systemic host response to microbial infection involves clinical signs and symptoms of infection, including fever and elevated white blood cell (WBC) counts. In addition, inflammatory

mediators are released, including activated complement product C3a, interleukin 6 (IL-6) **(Johan *et al.*, 2001)**.

The emergence of antibiotic-resistant organisms is a major public health concern, particularly in hospitals and other health care settings **(Schwartz *et al.*, 1997; Spellberg *et al.*, 2008)**. Medicinal plants are natural resources, yielding valuable products which are often used in the treatment of various ailments. According to the world health organization, more than 80% of the world populations still rely on herbal medicines as their primary source of health care. Because of the concern about the side effects of conventional medicine, the use of natural products as an alternate to conventional treatment in healing and treatment of various diseases has been on the rise in the last few decades **(Saeed and Tariq, 2007)**.

Consequently, there is concern that in the not-too-distant future, we may be faced with a growing number of potentially untreatable infections **(Michael *et al.*, 2009)**.

Plant materials remain an important resource for combating illnesses, including infectious diseases, and many of the plants have been investigated for novel drugs or templates for the development of new therapeutic agents **(Konig, 1992)**.

AIM OF WORK

Our Study Aimed To:

- **Microbial resistance to antibiotics** is a deep problem in medicinal treatment. So search for new substances overcome this resistance is necessary.
- **Our work is to search for new substances extracted from plant materials** and investigate its antimicrobial activity against bacterial infection of surgery wounds that is resistant to antibiotics.
- **In addition,** determination C-reactive protein and interleukin-6 in patient blood serum.