ISSN: 2833-9312

Mini Review Article

World Journal of Clinical & Medical Images

Medicinal Plants and Pseudomonas *Aeruginosa*: Is That The Solution for Antibiotic Resistance?

Rim M. Harfouch*

Department of Microbiology and Biochemistry, Faculty of Pharmacy, Tishreen University, Latakia, Syria.

***Corresponding Author**
Rim M. Harfouch, Department of Microbiology and Biochemistry, Faculty of Pharmacy, Tishreen University, Latakia, Syria.

Submitted: 2023, July 04; **Accepted:** 2023, July 26; **Published:** 2023, Aug 28

Citation: Harfouch, R. M. (2023). Medicinal Plants and *Pseudomonas Aeruginosa:* is that the Solution for Antibiotic Resistance?. *World J Clin Med Img, 2*(2), 65-67.

Abstract

Peudomonas aeruginosa is an opportunistic pathogen causing severe, acute, and chronic nosocomial infections in urinary and pulmonary tracts, burns, and wounds. Currently, there is an urgent and global need for alternative antimicrobial strategies to fight the continuous rise of P. aeruginosa's resistance to different antibiotics. In this review, we summarize the antibacterial effect of several plant extracts and essential oil, specifically honey, propolis, and essential oil extracted from Cupressus macrocarpa Leaves, Taraxacum officinale extract, and Citrus limon Peel Extracts.

Keywords: Phytochemicals, Medicinal Plants, *Pseudomonas Aeruginosa*, Antibiotic Resistance.

1. Introduction

The multi-drug resistant bacteria to antibiotics is a global problem and widespread which leads to infection that is difficult to treat and may result in death. Antibiotic resistance has affected people at any time or age of life and this makes it one of the biggest world's public health problems [1]. *Peudomonas aeruginosa* is an opportunistic pathogen causing severe, acute, and chronic nosocomial infections in urinary and pulmonary tracts, burns, and wounds. Currently, there is an urgent and global need for alternative antimicrobial strategies to fight the continuous rise of P. aeruginosa resistance to different antibiotics. Strains of *Pseudomonas aeruginosa* are known to utilize their high levels of intrinsic and acquired resistance mechanisms to counter most antibiotics [2]. In addition, adaptive antibiotic resistance of *P. aeruginos*a is a recently characterized mechanism, which includes biofilm-mediated resistance and is responsible for recalcitrance and relapse of infections. The most exposed patients to the risk of infection and reaching a critical condition are those with weak immunity especially hospitalized and intensive care patients, especially those who suffer from chronic lung diseases [3].

2. Effect of Honey on *Peudomonas Aeruginosa*

Results from several studies confirm that honey from different countries and regions may have wide variations in its antimicrobial activity. It has been shown that honey may have antimicrobial action ranging from lesser than 3% to 50% and higher concentrations. Several authors also reported that the antibacterial efficacy of honey differs greatly from plant sources. Honey may inhibit bacterial growth due to a number of different mechanisms such as the osmotic effect, low pH, hydrogen peroxide generation, and phytochemicals. The combination of these diverse mechanisms may account for the inability of bacteria to develop resistance to honey, in contrast to the rapid induction of resistance observed with conventional single-component antibiotics. Since P. aeruginosa are recalcitrant to antibiotic therapy, the efficacy of honey to inhibit test isolates irrespective of their antibiotic sensitivity patterns has important clinical applications. This property may make honey useful in the treatment of drug-resistant infections [4].

3. Effect of Propolis on *Peudomonas Aeruginosa*

Propolis is a mixture of beeswax and resins collected by the honeybee from different plant buds, leaves, and exudates. Bees use propolis not only as a building material but also as a means of maintaining low levels of bacterial and fungal concentration in the hive [5].

Studies showed that the ethanolic extract of propolis (EEP) is more effective on gram-positive bacteria than gram-negative ones, the ethanolic extract of propolis completely inhibits the growth of Staphylococcus aureus Staph. epidermidis, and partially inhibits the growth of Pseudomonas aeruginosa and Escherichia coli [6].

4. Effect of Essential Oil Extracted from *Cupressus Macrocarpa* Leaves

Cupressus has traditionally been used for the treatment of colds, flu, and rheumatism. It is considered to be a medicinal tree, as its dried leaves are used for stomach pain, as well as to treat diabetes, and its dried fruit is used to treat inflammation, toothache, and laryngitis and as a contraceptive and astringent. Also, the

brunches of cupressus are used as antiseptic and antispasmodic. The essential oil extracted from C. macrocaroa leaves is used to treat rheumatism and whooping cough. A previous study found the high activity of C. macrocarpa essential oil against Staphylococcus aureus and Pseudomonas aeruginosa making it a good choice for preservative and therapeutic purposes. The surprising results showed that the essential oil extracted from C. macrocarpa had lower minimum inhibitory concentration (MIC) and higher efficacy than some third-generation antibiotics (Ceftriaxone, Cefuroxime, Nitrofurantoin, and Colistin) [7].

5. Effect of Essential Oil of *Rosmarinus Officinalis* and *Salvia Officinalis*

Rosmarinus officinalis and Salvia officinalis are widely used in folk medicine, cosmetics, and flavoring of food products. Furthermore, they are defined as very powerful aromatic plants and their essential oils possess antimicrobial, antiviral, antifungal, antioxidant, hepatoprotective, and anticarcinogenic properties. The findings in a previous study showed that the MIC of Rosemary essential oil against P. aeruginosa was 0.78% (v/v), and the main compounds with antimicrobial effects in rosemary essential oil are 1,8- cineole, α-pinene, and camphor. Rosmarinus officinalis essential oil exhibited higher antibacterial activity against Pseudomonas aeruginosa than this Salvia officinalis [8, 9].

6. Effect of *Taraxacum Officinale* on *Peudomonas Aeruginosa*

Taraxacum officinale (dandelion) is a wild plant and can be planted, both types contain good amounts of bioactive chemicals, chicoric acid, taraxasterol, chlorogenic acid, lactones, and vitamins. Roots have a high content of phenolic compounds which make the extract effective against *staphylococcus aureus* and *Peudomonas aeruginosa*. According to a recent study, the root extract gave a specific efficacy of 17 mm inhibition diameter toward *Pseudomonas aeruginosa* which is known for its antibiotic resistance and the same strain was not sensitive to the reference antibiotic. The importance of these results stems from the possibility of extracting the roots of the plant to affect the *Pseudomonas aeruginosa* [10].

7. Effect of Citrus Limon Peel Extracts on *Peudomonas Aeruginosa*

Citrus peels are rich in flavonoid glycosides, coumarins, sitosterol, and essential oils which can be extracted and added to several cosmetic and pharmaceutical products. Other active terpenes, as well as alcohols, aldehydes, and esters, contribute to the overall antimicrobial effects of the essential oils. The antibacterial potential in crude extracts of different parts (leaves, stem, root, and flower and peels) of Citrus limon against clinically significant bacterial strains has been reported. Citrus flavonoids have a large spectrum of biological activity including antibacterial, antifungal, antidiabetic, anticancer, and antiviral activities [11].

Previous research that studied the influence of *Citrus limon* oil in the virulence factors production and motility (swarming and swimming) of two *Pseudomonas aeruginosa* strains showed that Pyocyanin biosynthesis decreases until 64% and swarming motility of *P. aeruginos*a was completely inhibited by 2 mg mL^{-1} of lemon oils [12].

8. Conclusion

Many studies have been conducted to evaluate natural treatments against bacterial infections caused by multi-drug-resistant bacteria. Due to the high resistance rate of *P. aeruginosa* strains, a lot of research showed be conducted to find new remedies and utilize nature to combat the *P. aeruginosa* virulence factors.

References

1. Prestinaci, F., Pezzotti, P., & Pantosti, A. (2015). Antimicrobial resistance: a global multifaceted phenomenon. Pathog Glob Health 109: 309–318.
2. Harfouch, R. M., Khaddour, T., Jendi, E., & Elshimali, Y. (2022). Resistance and Sensitivity of Pseudomonas Aeruginosa against Common Used Antibiotics in Tishreen University Hospital, Syria. Journal of Immunology Research & Reports. SRC/JIRR-113.
3. Zam, W., Harfouch, R., Bittar, S., & Sayegh, M. (2017). Antibacterial activity of various Syrian honey types against Pseudomonas aueruginosa. Research Journal of Pharmacognosy and Phytochemistry, 9(2), 73-76.
4. Zam, W., Harfouch, R., Ali, R., Atfah, Y., & Mousa, A. (2018). Natural extracts and honey based impregnated gauze wound dressing preparation and in vitro antibacterial efficacy. Research Journal of Pharmacognosy and Phytochemistry, 10(1), 1-7.
5. Harfouch, R. M., Fead, R., Hammoud, L., & Harfouch, N. (2020). Efficacy of Syrian Propolis against Several Bacterial Strains. Journal of Medicine and Healthcare. SRC/JMHC-156.
6. Harfouch, R. M., Mohammad, R., & Suliman, H. (2016). Antibacterial activity of Syrian propolis extract against several strains of bacteria in vitro. World J. Pharm. Pharmaceuti. Sci, 6, 42-46.
7. Harfouch, R. M., Barakat, A., Chouman, F., Elshimali, Y., & Latakia, S. (2022). Antibacterial Effect of Essential Oil Extracted from Cupressus macrocarpa Leaves Against Several Bacterial Strains. Annal Clin Revie Cas Repor: ACRCR-101.
8. Harfouch, R. M., Darwish, M., Al-Asadi, W., Mohammad, A. F., Gharib, N. M., & Haroun, M. (2019). Antibacterial activity of essential oils of Rosmarinus officinalis, Salvia officinalis and Anthemis nobilis widespread in the Syrian coast. Research Journal of Pharmacy and Technology, 12(7), 3410-3412.
9. Harfouch, R. M., Darwish, M., Ghosh, S., Beesh, M., Ibrahem, N., Dayoub, H., ... & Ahamadi, S. (2021). Formulation and Preparation of a Novel Toothpaste Using the Essential Oil of Salvia officinalis. Available at SSRN 3770309.
10. Harfouch, R., & Ghosh, S. (2021). Antibacterial activities of widely spread Taraxacum officinale dandelion in Al-Qadmous, Syria as potential therapeutic strategy for antibiotic resistant bacteria. CPQ Medicine, 11, 1-13.
11. Harfouch, R. M., Janoudi, H., Muhammad, W., Hammami, A., & Chouman, F. (2019). In Vitro Antibacterial Activity of Citrus limon Peel Extracts against Several Bacterial Strains. Journal of Chemical and Pharmaceutical Research, 11(7), 48-51.
12. Luciardi, M. C., Blázquez, M. A., Alberto, M. R., Carta-

gena, E., & Arena, M. E. (2021). Lemon oils attenuate the pathogenicity of Pseudomonas aeruginosa by quorum sensing inhibition. Molecules, 26(10), 2863.