Original Article

Determination the Antibacterial Activity of Different Soil Samples in Erbil City

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ABSTRACT

Objective: Antimicrobial drugs have become limited useful against nowadays pathogens; this was because of highly uptake and consumption of previously drugs which leads to gain the resistance potential by Pathogenic microbes generally and bacterial pathogens specifically. Aim of this study is testing antibacterial capability of soil extracts.
Study Design: Standard antibacterial testing procedure
Place and Duration of Study: This study was conducted at the Iraq, Erbil, Sami-Abdul Rahman Park from October 2023 to December 2023.
Methods: We obtained the antimicrobial effect directly from soil extract and three soil samples from: the indoor plant roots, the random plant root and the grass soil, and mix them with 9 ml of Distilled water, and we used Ciprofloxacin (CIP) as positive control, then they have been checked for their antibacterial activity by well diffusion methods in order to get the inhibition zones which indicate their antibacterial activity. Four standard strains of bacterial species were used in this study, which were K. pneumonia (ATCC 13883), P. mirabilis (ATCC 14153), E. faecalis (ATCC 29212) and S. pneumoniae (ATCC 6303).
Results: Only the random plant root soil sample has slightly effect against K. Pneumoniae and they didn't have effects on the rest of bacterial strains.
Conclusion: Only random tree roots soil has effect on K. pneumoniae which was (4 mm) of inhibition zone and they didn't have effect on the rest of bacterial strains.
Key Words: Soil, Antibacterial, Well, diffusion method

Citation of article: Abdullah MO. Determination the Antibacterial Activity of Different Soil Samples in Erbil City. Med Forum 2024;35(2):90-92. doi:10.60110/medforum.350220.

INTRODUCTION

The prevalence of antimicrobial resistance among microorganisms is currently a significant global threat. Antibacterial resistance is the prevailing form of resistance observed across microbial groups. It refers to a collection of defense mechanisms that certain harmful bacteria have evolved to withstand the presence of antibacterial medications. Despite the successful synthesis of numerous chemically synthetic chemicals by researchers, the problem of antibiotic resistance remains a global issue, and these compounds have not yet proven to be viable alternatives to previously used medications.[1-3]

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Received: January, 2024
Accepted: January, 2024
Printed: February, 2024

Streptococcus pneumoniae, which is acquired in the community, and Enterococcus faecalis, which is acquired in healthcare settings, are pathogens that urgently require alternative antibacterial medicines due to their high rates of resistance.[4,5] On the other hands, People with urinary tract infections (UTIs) often contract P. mirabilis, a member of this family that has quickly evolved multidrug-resistant (MDR) strains resistant to a wide range of medications.[6] Klebsiella is a type of gram-negative bacterium belonging to the Enterobacteriaceae family. It is responsible for causing many illnesses such as respiratory tract infections, urinary tract infections, septicemia, pneumonia, and soft tissue infections. Currently, K. pneumoniae has emerged as a highly hazardous pathogen acquired in hospitals, characterized by a significant prevalence of resistant strains such as multidrug-resistant (MDR) and extended-spectrum beta-lactamase (ESBL) strains of K. Pneumonia.[7]

Soil has many beneficial microbes which are responsible for producing a wide variety of antimicrobial secondary materials, and has been checked and isolated by scientists in order to check their activity against harmful microbes (pathogens).[8]

The objective of our study was to determine the antibacterial activity of three soil samples collected from both indoor and outdoor tree roots against four

different pathogenic bacteria: S. pneumonia, P. mirabilis, Klebsiella pneumonia and E. faecalis.

METHODS

Three soil samples have been collected in the three different places (near the indoor plant roots, the random plant root and the grass soil); Ciprofloxacin (CIP) was used as positive control and Distilled water as negative control. One gram from each samples were mixed with 9 ml of distilled water in order to dissolve all the microbial waste products into the water, then they were centrifuged to remove the unwanted soil particles, then were sterilized through 20 micrometer syringe filter (Minisart®, Biotech, USA). Stocked bacteria as being seen in Table 1 were reactivated in Nutrient Broth media, and then the bacterial numbers were adjusted to McFarland (0.5) turbidity by comparing with standard McFarland (0.5) tube.

To conduct the well-diffusion assay, swabs were spread out on Mueller Hinton agar plates from each bacterial suspension. After drying, 100µl of each soil extracts was poured into each well, along with a positive control (CIP) and a negative control (DW) on each plate. The plates were then incubated at 37°C for about 24 hours. When the incubation period is up, we look for distinct areas surrounding each well; these are the inhibition zones, which we compare to our positive control. The data was entered and analyzed through SPSS-26.

RESULTS

Following incubation in a well diffusion experiment for 24 hours, the inhibition zones surrounding each samples and its control on each plate were measured in millimeters using a ruler. These measurements were then compared to the two controls (positive control and negative control). Inhibition zone of all compounds with CIP is presented in (Table 2).

Out of three different soil samples from garden and indoor plant roots which have been checked against all our tested standard bacterial strains by using a standardized technique (well-diffusion). In the results, all soil samples didn't have any effect against all standard bacteria, in exception of K. pneumoniae, in which there is slightly effect against random tree roots soil extract. The inhibition zone mean for the affected sample was (4 mm). While on the other side, our positive control (CIP) showed inhibition effect, in which the inhibition zone mean vales were 19, 15, 10 and 7 mm for P. mirabilis, K. pneumoniae, E. Faecalis and S. pneumonia, respectively. The inhibition zone means value has been illustrated in (Fig. 1).

Table No.1: The bacterial species with their Standard codes

Bacterial species	ATCC Code
P. mirabilis	14153
K. pneumonia	13883
E. faecalis	29212
S. pneumonia	6303

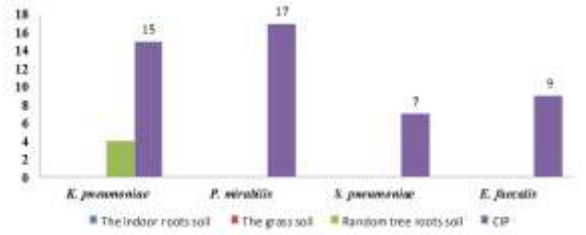

Figure No. 1: The inhibition zone Mean values for Soil samples and positive control (CIP)

Table No.2: Zone of inhibition of all Soil samples with Ciprofloxacin

Compound	Bacterial strains			
	K. pneumoniae	**P. mirabilis**	**S. pneumoniae**	**E. faecalis**
	Inhibition zone (mm)	Inhibition zone (mm)	Inhibition zone (mm)	Inhibition zone (mm)
The indoor roots soil	/	/	/	/
The grass soil	/	/	/	/
Random tree roots soil	4	/	/	/
CIP	15	19	7	10

DISCUSSION

After testing our soil extract samples by well diffusion method, we showed that they don't have direct antibacterial potential against all bacterial strains. Even though there was slightly effect against K. pneumoniae.

In the present study, opposite to other researches which has been done before, we were directly extract microbial secondary products from soil samples which were near the plants root. While in previous study, isolating bacteria or fungi from soil samples, then checked these microbes product individually against pathogens.[8]

Our study idea was designed on the fact that the soil has many microbes which are responsible to produce various antimicrobial, especially antibacterial such as explained in the study by Cycoń et al[9], but unfortunately the amount of by product solutes were not enough to have effect on our standard bacterial cultures.

K. pneumonia was the only tested bacteria which had the response against random tree roots sample extract, which indeed pointed to the closely relation of these bacteria with the other soil microbes such as shown in the study of Cruz-Córdova et al[10], while other bacteria represent the mostly resistant pathogenic bacteria that have many resistance mechanism against these soil extracts.

CONCLUSION

The increasing uptake and consumption of previously prescribed antimicrobial medications has led to the development of resistance in pathogenic microorganisms, particularly bacterial pathogens, and has reduced the efficacy of these treatments against modern infections. So regarding to this, we conducted our study to obtain antimicrobial effect directly from soil extract. In our study we obtained three soil samples and checked through a standardized antibacterial (well diffusion) methods in order to get the IZ and evaluate their potential against four common standard bacterial strains. In outcomes, our finding showed that only Random tree roots soil has effect on K. pneumoniae which was (4 mm) of inhibition zone and they didn't have effect on the rest of bacterial strains.

Author's Contribution:

Concept & Design of Study:	Mohammed Omar Abdullah
Drafting:	Mohammed Omar Abdullah
Data Analysis:	Mohammed Omar Abdullah
Revisiting Critically:	Mohammed Omar Abdullah
Final Approval of version:	Mohammed Omar Abdullah

Conflict of Interest: The study has no conflict of interest to declare by any author.

Source of Funding: None

Ethical Approval: No. 10/114 dated 25.09.2023

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