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Determination of the Activity of the Green Synthesized Silver Nanoparticles Against Multidrug Resistant Bacteria Isolated from Children with Diarrhea under Five Years

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This is a M Sc thesis that was conducted in Tikrit University College of Science, Tikrit, Iraq, in 2018, under the supervision of Assistant professor Dr. Mohamed Nadhir, Tikrit University College of Education for Pure Sciences, Tikrit, Iraq.
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Background: Bacterial resistance to wide range of antibiotics increased dramatically in the last decade. The most serious of such resistant is the multidrug resistance that leads to failure of treatment and increase in morbidity and mortality.
Aim: To evaluate the synergistic inhibition of combination of nano particles with antibiotics against multidrug resistant bacteria.
Materials and methods: One hundred twenty stool specimens were collected from children under five years old with diarrhea. These samples were collected during the period from May 2015 to October 2015 from different hospitals in Baghdad (Child Central Hospital, Children's Welfare Hospital and AL-Karama Hospital). Isolation and identification of bacterial isolates were carried out according to the morphology and biochemical characteristics. Antibiotic susceptibility test for 116 bacterial isolates was performed using disk diffusion method.
Results: The highest rate of diarrhea (61.2%) was recorded at age group less than 12 months. Bacterial isolation frequency was 34.48% for *Escherichia coli, 2.68% for Salmonella typhi, 9.48% Proteus mirabilis, 9.48% Pseudomonas aeruginosa, 9.48% Klebsiella pneumonia, 5.17% Citrobacter freundii, 5.17% Enterobacter aerogenes* , 2.58% *Shigella sonnei*, 2.58% *Serratia marcescens* and 0.86% *Hafnia alvei*. Results showed a dissimilar resistance rates towards different antibiotics, ten bacterial isolates were collected for each bacterial species to study their resistance patterns, the ones with the highest resistance rate were selected for further study. Meanwhile, easy and cheap green method using the banana peel extract (BPE) was applied to synthesize silver nanoparticles (AgNPs). Phytochemicals of banana peel extract were screened by standard methods. The results verified the existence of alkaloids, flavonoids, and glycosides in it. These components acted as a reducing agent, stabilizing and capping agents for AgNO3 with the assistance of the microwave. The successful preparation of AgNPs was established by ultraviolet–visible spectroscopy which showed the absorption peak at 415 nm. The size and shape of AgNPs were characterized by Transmission Electron Microscopy (TEM), which indicated spherical shaped of AgNPs with size of around 9-15 nm. Dynamic light scattering (DLS) demonstrated the average size of colloidal AgNPs which was around 40.5 nm. Also Fourier Transform Infrared Spectroscopy (FTIR) measurements confirmed the role of BPE as a reducing and capping agent of silver ions. In addition zeta potential was measured to evaluate the stability of particles and showed that the stability was about -30.99 mv. Moreover, penicillin G - AgNPs and chloramphenicol-AgNPs nanocomposite were synthesized (separately) and characterized via employing UV-

Vis Spectroscopy, DLS and FTIR spectroscopy to confirm successful preparation of nanocomposite. The antibacterial activity of the AgNPs and the nanocomposite effects of biosynthesis AgNPs with penicillin G and chloramphenicol antibiotics against multidrug resistance (MDR) bacteria were studied by using disk diffusion method. Results showed a good effect against MDR isolates. The synergistic effects of biosynthesis AgNPs at different concentrations with different standard antibiotic discs (Tobramycin, Chloramphenicol, Nitrofurantoin, Ampicillin- sulbactam and Nalidixic acid) against MDR bacteria were also investigated.

Conclusion: This study showed that there was the synergistic action of AgNPs and antibiotics led to enhancement of antibacterial activity. So, the dose of an antibiotic administered can be reduced and subsequently decrease the adverse effects.