Abstract

Introduction:

Cancer remains a significant global health concern, necessitating the exploration of novel anti-cancer treatments. Extensive research supports the potential of using plant extracts and silver nanoparticles (AgNPs) as a safer and more effective alternative treatment for cancer patients. Our study specifically investigates the antibacterial and anticancer properties of silver nanoparticles and bio-components from *Rhazya Stricta (R.S.)* extract, synthesized using silver nitrate (AgNO3). By exploring this treatment option, we aim to provide a safer and more effective alternative to chemotherapy, which can cause severe side effects and increased infection risks for patients.

Method:

AgNPs were synthesized using an aqueous extract of *R.S.* aerial parts. The organic components were detected using Fourier Transform Infrared (FTIR) spectroscopy, while size distribution, morphology, and surface analysis were examined using Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM) with Energy Dispersive X-ray (EDX) analysis, and Zetasizer measurements. The cytotoxicity of AgNPs was evaluated using an MTT assay on various cancer cell lines (KAIMRC2, MDA-MB231, MCF-7, HCT-116, and MCF-10A). Liquid Chromatography-Mass Spectrometry (LC-MS) was employed to identify biometabolites. Additionally, the antibacterial activity of the prepared nanoparticles was evaluated against *Staphylococcus aureus (S. aureus)* and *Escherichia coli (E. coli)* bacterial strains.

Result:

FTIR analysis confirmed the successful synthesis of AgNPs. The average size of AgNPs synthesized was 54.30 nm. SEM and EDX analysis showed specially shaped NPs and the presence of several bio-molecules, mainly carbon, oxygen, and silver. The MTT assay demonstrated the cytotoxic activity of AgNPs synthesized from *R.S.* extract against various cancer cell lines, with IC_{50} values of 204.5 µg/mL, 154.7 µg/mL, and 168.1 µg/mL, 162.9 µg/mL, 321µg/mLrespectively. The cytotoxicity was further enhanced after coupling the *R.S.* extract with AgNO3. Additionally, AgNPs exhibited antimicrobial activity against *S. aureus* and *E. coli* strains, with larger zones of inhibition (19mm, 20mm) compared to the crude extract (13mm, 10mm).

Conclusion:

Our study shed light on the potential use of medicinal plant-encapsulatednanoparticles for treating fatal human diseases. The utilization of *R.S.* extract in the synthesis of AgNPs demonstrated promising cytotoxic activity against various cancer cell lines. Moreover, such AgNPs treated with *R.S.* extract enhanced antimicrobial activity against pathogenic strains, particularly *S. aureus,* and *E. coli.*

Keywords
Rhazya stricta; nanoparticles; anti-cancer therapy; in *vitro* studies; liquid chromatography-mass spectrometry