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Novel Nanoformulation to Control Bovine Mastitis Causing MDR Pathogen †

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Abstract: Mastitis is the most widespread and costly disease in dairy cattle occurring throughout the world. The increased use of antibiotics has led to a global increase in the number of antibiotic-resistant microbes. Therefore, there is an urgent need to overcome the limitations of conventional antibiotics. Recently, nanotechnology advancements have led to the development of nanoparticles to overcome restrictions posed by conventional antimicrobial agents. Hence, Novel, environmentally friendly, cost-effective, biocompatible, and long-term antibacterial particles represent a promising solution for medicine and farming. Mastitis Milk samples were collected from infected cows, and the organisms were isolated. The susceptibility of the organisms was screened through different antibiotics. Green nanoformulation (GNF) was synthesized and characterized using UV spectroscopy, Fourier-transform infrared spectroscopy, and zeta potential techniques. All the isolated strains were tested with GNF and compared with antibiotics. Minimum Inhibitory Concentration (MIC), Minimum Bactericidal Concentration (MBC), and Biofilm assays were performed at different GNF concentrations, and antibacterial effects were quantified, and the genes responsible for antibiotic resistance were analyzed to identify the mechanism of infection and pathways critical for causing mastitis. In our results, MIC and MBC of GNF showed antimicrobial activity against all the strains but at different concentrations. The results suggested that GNF could penetrate the bacterial cell wall and inhibited bacterial growth. The biofilm formation was also inhibited by GNF in all isolated strains when compared to control. The results suggested that the inhibition of biofilm formation by GNF might be due to the presence of polyphenolic bioactive compounds. Our results indicated that GNF could reduce the virulence factors responsible for infection by different bacterial strains. GNF showed a significant and potent antibacterial and anti-biofilm activity against Gram-negative and Gram-positive strains. This study confirmed that GNF had the potential to inhibit the growth of pathogenic organisms and could be utilized as an alternative, affordable, easily available, and cost-effective source of antibiotics to inhibit multi-drug-resistant microbial pathogens in cattle's.

Keywords: mastitis; green nanoformulation; bacteria; pathogenesis; minimum inhibitory concentration (MIC); minimum bactericidal concentration (MBC); biofilm.

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Conflicts of Interest

The authors declare no conflict of interest.