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Effects Of Nanoparticles On *Escherichia Coli* Causing Diarrhea In Ruminants

A thesis Presented

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7- Summary

Emerging infectious diseases and the increase in incidence of drug resistance among pathogenic bacteria have made the search for new antimicrobials inevitable. In the current situation, one of the most promising and novel therapeutic agents are the nanoparticles. The unique physiochemical properties of the nanoparticles combined with the growth inhibitory capacity against microbes has led to the upsurge in the research on nanoparticles and their potential application as antimicrobials.

Among the various metal oxides studied for their antibacterial activity, titanium dioxide and zinc oxide nanoparticles have been found to be highly toxic. Moreover, their stability under harsh processing conditions and relatively low toxicity combined with the potent antimicrobial properties favors their application as antimicrobials. Many studies have shown that some NPs made of metal oxides, such as ZnO NPs, have selective toxicity to bacteria and only exhibit minimal effect on human cells, which recommend their prospective uses in agricultural and food industries.

Therefore, this study was designed to throw spot lights upon the effect of these NPs on pathogenic multiple drug resistant ***E. coli*** causing diarrhea.

1. In this study, *E. coli* was isolated from 150 fecal samples collected randomly from diarrheic calves (n=35), lambs (n=35) and goat kids (n=80) up to 3months from Gimmeza animal production researches station farm. Agriculture Research Centre (ARC).and the result were summarized as following:
2. Eighty two *E. coli* isolates were isolated from 150 fecal samples with incidence (54.6%=82/150).,as follow the number of *E. coli* isolates from calves was 28 with an incidence 80%, from goat kids was 39

with an incidence 48.7% and from lambs was 15 with an incidence 42.8 %.

3. The number of pathogenic *E. coli* was 48 with an incidence 58.5 %and 41.5% nonpathogenic ones.
4. Out of 48 pathogenic *E. coli* isolates 85% were resistant to Oxytetracycline (OT) followed by Ampcillin (AMP) 83%, Chloramphenicol (CHL) 60% and cefotaxime (CTX) 20% but no resistance to Amoxicillin+clavulinic acid(AMC), Ciprofloxacin(CIP), Gentamicin (GN) and Erythromycin (ER). Among those *E .coli* isolates, 10 isolates were found to be multi-drug resistant to 3 or more antibiotic groups.
5. Serogrouping of the 10 MDR *E. coli* isolates revealed that the serogroups were *E. coli* O_{157}:H_7 (4/10) isolated from calves (n=2) and goat kids (n=2), and *E. coli* O_{125} three (3/10) isolated from calves (n=2) and lambs (n=1) and three O_{44} (3/10) isolated from goat kids (n=2) and sheep (n=1).
6. ZnO, TiO_2, Ag-TiO_2 and Ag-ZnO were prepared via the sol-gel method.
7. The synthesized NPs were characterized using XRD and TEM. XRD pattern of the prepared ZnO and Ag-doped ZnO powder revealed the hexagonal wurtzite phase With size equal to 26 nm and 19 nm respectively, But TiO_2 has anatase phase with size equal 32nm and Ag-doped TiO_2 has both rutile and anatase phases with size equal 15nm
8. TEM analysis showing the particles are scattered in the case of ZnO and Ag-doped ZnO nanoparticles (Ag NPs<10 nm), ZnO nanoparticles (15–50 nm) and showed the particles are irregular in

shape, agglomerated in the case of TiO_2 whereas they are scattered in the case of Ag-doped TiO2 Nps, particles size about (25–60 nm).

9. The antibacterial results showed that the low antibacterial activities of pure TiO_2 and ZnO were significantly improved by the incorporation of silver.
10. Ag-doped TiO_2 treatments showed the most significant antibacterial activities against *E. coli* followed by Ag-doped ZnO then TiO_2, while ZnO have the lowest antibacterial activity.
11. The synthesized NPs found to be effective against all *E. coli* strains with MIC of ZnO occurred at (31,25µg/ml) for O_{157H7}, while MIC of TiO_2 occurred at (15,6 µg/ml) for O_{44}, MIC of Ag-doped ZnO occurred at (7,8 µg/ml) for and MIC of Ag-doped TiO2 showed at 3,9 µg/ml for (ATCC25922).
12. TEM analyses was used to assess the morphological change of bacterial cells induced by the treatment of ZnO, TiO_2, Ag doped ZnO, Ag doped TiO_2 NPS .The leakage of intracellular contents and membrane disorganization were observed in bacterial cells treated with mentioned NPs**.**