Faculty of Veterinary Medicine
Department of Microbiology

Impact of Zinc Oxide Nanoparticles in growth and virulence of some foodborne bacteria

A Thesis presented by

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(B.V. Sc. Zagazig University 2008)

For the Degree of Master
In Veterinary Medical Science,
Microbiology (Bacteriology, Immunology and Mycology)

Under Supervision of

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Supervision Sheet

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ABSTRACT

The antibacterial activities of synthesized and commercial zinc oxide nanoparticles (ZnO NPs) were analyzed to ensure their effectiveness as food preservative against *S.* Typhimurium, *S. aureus* and *E. coli*. ZnO NPs were synthesized by a wet chemical method, identified and characterized by UV-visible spectrophotometer, Transmission electron microscope (TEM) and (XRD) for confirmation synthesis. The antibacterial activities of synthesized and commercial ZnO NPs were analyzed. Synthesized ZnO NPs showed inhibition for *S. aureus*, *E. coli* and *S.* Typhimurium with MIC 0.3 mg/ml, 0.6 mg/ml and 1.25 mg/ml respectively. while the MIC of commercial ZnO nanomaterial was found to be 0.15 mg/mL for *S. aureus* and 0.3 mg/mL for *E. coli and S.* Typhimurium. Using RT-PCR, the gene expression of gamma hemolysin (*hlg) and* aggregation genes *(csgD)* in media treated with subMIC concentration ZnO NPS were reduced. The present in vivo study was aimed to investigate the oral toxicity of ZnO NPs, Sprague Dawley rats were administered with 50, 200, 300 mg/kg body weight (b.w) of nanosized zinc oxide suspended in distilled water through oral gavage. The effects of ZnO NPs on some immunological parameters were analyzed on day 30 of administration. The organs were collected for histopathology. Interestingly, dose-dependent decrease in serum total protein and serum albumin. Also significant leukocytosis ($P \leq 0.05$), a significant increase in neutrophil, and monocyte and a decrease in lymphocyte which are dose- dependent. The incidences of microscopic lesions in liver and kidney were higher in higher doses of ZnO NPs compared to the lower dose and control group.

Dedicated to my family

my father

my mother

my brother

my husband

my daughters (Hana & Alia)

and

my aunt (Dr. Eman El-Safy)

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Ag	Silver
AHRI	Animal Health Reasearch Institute
Alb	Albumin
ALP	Alkaline phosphatase
ALT	Alanine Transaminase
ANOVA	Analysis of Variance
AST	Aspartate Transaminase
BAS	Basophil
bp	Base pair
BUN	Blood Urea Nitrogen
BW	Body weight
CFU	Colony forming units
CLSI	Clinical and Laboratory Standards Institute
cPCR	Coventional Polymerase Chain Reaction
csgD	Curlin subunit gene D
CT	Cycle threshold
DLC	Differential Leukocytic Count
EDTA	Ethylene Diamine Tetra Acetic acid
EDX	Energy Dispersive X-Ray Spectrometer
ENMs	Engineered nanomaterial
EOS	Eosinophil
FDA	Food and Drug Administration
FT-IR	Fourier Transmitter Infrared
G.I.	Gastrointestinal

GHS	Globally Harmonized Classification System
GRAS	Generally recognized as safe
HB	Hemoglobin
HCT	Hematocrit
hlg	Hemolysin gamma
HRTEM	High Resolution Transmission Electron Microscopy
I.P.	Intraperitoneal
ISS	Increased serum survival
LYM	Lymphocyte
MBC	Minimum bactericidal concentration
MCH	Mean corpuscular hemoglobin
MCHC	Mean corpuscular hemoglobin concentration
MCV	Mean corpuscular volume
MIC	Minimum inhibitory concentration
MON	Monocyte
NEU	Neutrophil
nm	Nanometer
NOAEL	No-observed-adverse effect level
NPs	Nanoparticles
OECD	Organization for Economic Cooperation and Development
PCR	Polymerase Chain Reaction
PT	Platelet
RNA	Ribo Nucleic Acid
ROS	Reactive oxygen species
RT-PCR	Real Time-Polymerase Chain Reaction