



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,

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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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List of Contents

1. Introduction.....	1
2. Review of literature	4
2.1. Nanoparticles and food preservation	4
2.2. Synthesis of ZnO Nanoparticles	7
2.3. Antibacterial effect of ZnO Nanoparticles	14
2.4. Virulence genes	27
2.4.1. Virulence genes for <i>S. aureus</i>	27
2.4.2. Virulence genes of <i>E. coli</i> and <i>S. Typhimurium</i>	29
2.4.3. Effect of ZnO NPs on gene expression for microbial virulence factor	31
2.5. Safety and toxicity of ZnO nanoparticles	34
3. Materials and Methods.....	44
3.1. Materials	44
3.1.1. Commercial ZnO NPs	44
3.1.2. Material used for synthesis ZnO NPs	44
3.1.3. Bacterial strains	45
3.1.4. Media	45
3.1.5. Materials used for biochemical confirmation	47
3.1.6. Stain	48
3.1.7. Material used for determination of minimal inhibitory concentration	48

3.1.8. Material used for extraction of DNA.....	49
3.1.9. Material used for PCR	50
3.1.10. Material used for SYBR Green real time PCR.....	53
3.1.11. Experimental animals	55
3.1.12. Material used for immunological examination.....	56
3.1.13. Chemicals used for routine histopathological examination	57
3.1.14. Glassware and plastics, other materials.....	57
3.2. Methods.....	58
3.2.1. Commercial ZnO nanoparticles.....	58
3.2.2. Synthesis of ZnO nanoparticles.....	58
3.2.3. Characterization of ZnO nanoparticles.....	58
3.2.4. Confirmation of <i>S. aureus</i> , <i>E. coli</i> and <i>S. Typhimurium</i> ...	59
3.2.5. Biochemical confirmation of <i>S. aureus</i> , <i>E. coli</i> and <i>S.</i> <i>Typhimurium</i>	59
3.2.6. Determination of the MICs of synthesized and commercial ZnO NPs	59
3.2.7. Detection of virulence gene of <i>S. aureus</i> , <i>E. coli</i> and <i>S. Typhimurium</i> by PCR (Pilot testing)	62
3.2.8. Effect of sub-MIC concentration of commercial ZnO nanoparticles on expression of virulence gene by real time PCR.....	66
3.2.9. Oral toxicity of ZnO NPs.....	70

4.Result.....	73
4.1. Characterization of commercial ZnO NPs.....	73
4.2. Synthesis of ZnO NPs	73
4.3. Identification and characterization of synthesized ZnO NPs.....	74
4.4. Evaluation of the antibacterial effect of metal nanoparticles (MIC).....	76
4.5. Results of Polymerase chain reaction (Pilot test).....	77
4.6. Effect of Sub-MIC concentration of commercial ZnO NPs on expression of (<i>hlg</i> and <i>csgD</i>) virulence genes	78
4.7. Oral toxicity of ZnO NPs	84
4.7.1. Immunological results of different peripheral blood cells .	84
4.7.2. Results of some serum immunological parameters	88
4.8. Histopathological findings.....	90
5. Discussion.....	95
6. Summary.....	114
7. References	116

List of Tables

Table (1): Oligonucleotide primers sequences used in cPCR	51
Table (2): Oligonucleotide primers used in SYBR Green real time PCR.....	55
Table (3): Master Mix preparation for PCR	64
Table (4): Cycling conditions for amplification of virulence gene during cPCR	65
Table (5): Master Mix preparation SYBR green real time PCR.....	68
Table (6): Cycling conditions during SYBR green real time PCR.....	69
Table (7): The MIC values of ZnO NPs against <i>S. aureus</i> , <i>E. coli</i> and <i>S.</i> <i>Typhimurium</i>	77
Table (8) PCR result for presence of different virulence genes	78
Table (9): Changes in (<i>hlg</i> & <i>csgD</i>) Gene expression at sub-MIC doses of ZnO NPs nanoparticles	84
Table (10): Result of Leukogram (control and ZnO NPs- treated groups)	85
Table (11): Some serum biochemical parameters (control and ZnO NPs- treated groups)	88

List of Photos

- Photo (1):** TEM images of commercial ZnO NPs 73
- Photo (2):** TEM images of synthesized ZnO NPs 76
- Photo (3):** Liver of control rat showing normal histological structure of the central vein (C) and hepatic cells (HC) 92
- Photo (4):** Kidney of control rat showing normal histological structure of the renal glomeruli (G) and renal tubules (T)..... 92
- Photo (5):** Liver of 50 mg/kg ZnO NPs administrated rat showing congestion of the central vein (C) and hepatic sinusoids (arrow) with mild swelling of the hepatic cells 92
- Photo (6):** Liver of 50 mg/kg ZnO NPs administrated rat showing swelling and mild degeneration of the hepatic cells with scattered necrotic cells (arrow) 92
- Photo (7):** Kidney of 50 mg/kg ZnO NPs administrated rat showing mild degenerative changes of the renal tubular epithelial linings with scattered appearance of granular cast (arrow) in the lumen of some tubules..... 92
- Photo (8):** Liver of 200 mg/kg ZnO NPs administrated rat showing hepatocellular swelling, granular and vacuolar (dashed arrow) degeneration and necrotic cells (arrow) with mild Kupffer cells activation (arrow head) 93
- Photo (9):** Liver of 200 mg/kg ZnO NPs administrated rat showing hepatocellular vacuolation, necrotic cells and apoptotic cells 93
- Photo (10):** Kidney of 200 mg/kg ZnO NPs administrated rat showing moderate degeneration (arrow) of the tubular epithelium, scattered necrotic cells and moderate thickening of the parietal epithelium of the Bowman's capsule (arrow head) 93

- Photo (11):** Kidney of 200 mg/kg ZnO NPs administrated rat showing mild thickening of the glomerular basement membrane with mild proliferation of the parietal epithelium of the Bowman's capsule and mild hypercellularity of the glomerular tuft , notive vacuolar deegenartion of the tubular epithelim..... 93
- Photo (12):** Liver of 300 mg/kg ZnO NPs administrated rat showing congestion of the hepatic sinusoid, marked degeneration and necrosis of the hepatic cells and marked activation of Kupffer cells 94
- Photo (13):** Liver of 300 mg/kg ZnO NPs administrated rat showing severe hepatocellular swelling, vacuolar degeneration and necrosis 94
- Photo (14):** Kidney of 300 mg/kg ZnO NPs administrated rat showing severe vacuolar degeneration, necrosis with scarttared nuclear pyknosis of the renal tubular epithelium and inter-tubular hemorrhages..... 94
- Photo (15):** Kidney of 300 mg/kg ZnO NPs administrated rat showing swelling of the glomerular tuft, vacuolation of the mesangium and desquamated tubular epithelium and few granular cast 94
- Photo (16):** Kidney of 300 mg/kg ZnO NPs administrated rat showing severe medullary intertubular hemorrhages 94

List of Figures

Figure (1): The UV-VIS absorbance spectra of ZNO-NPs	75
Figure (2): The X-ray diffraction pattern of zinc oxide nanoparticles in powder sample.....	75
Figure (3): Agarose gel electrophoresis of different virulence gene showing positive amplification of (<i>hlg</i> , <i>icaD</i> , <i>csgD</i> and <i>stn</i>) genes in tested strains and negative amplification of <i>iss</i> gene.....	77
Figure (4): Amplification curves of SYBR green RT- PCR for staph 16SrRNA gene showing variable CT values of control and treated samples	79
Figure (5): Amplification curves of SYBR green RT- PCR for staph <i>hlg</i> gene showing variable CT values of control and treated samples	80
Figure (6): Amplification curves of SYBR green RT- PCR for <i>E. coli</i> 16SrRNA gene showing variable CT values of control and treated samples	81
Figure (7): Amplification curves of SYBR green RT- PCR for <i>salmonella</i> 16S rRNA gene showing variable CT values of control and treated samples	82
Figure (8): Amplification curves of SYBR green RT- PCR for (<i>S. Typhimurium</i> and <i>E. coli</i>) <i>csgD</i> gene showing variable CT values of control and treated samples.....	83
Figure (9): Result of Leukogram (control and ZnO NPs-treated groups).....	86
Figure (10): % of non-segmented neutrophil (control and ZnO NPs-treated groups)	86

Figure (11): % of lymphocyte (control and ZnO NPs-treated groups).....	87
Figure (12): % of monocyte (control and ZnO NPs-treated groups).....	87
Figure (13): Total protein level(g/dl) (control and ZnO NPs-treated groups).....	89
Figure (14): Albumin level (g/dl) (control and ZnO NPs-treated groups).....	89

List of Abbreviations

Ag	Silver
AHRI	Animal Health Research 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	Conventional 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