MODULATION OF CADMIUM TOXICOKINETICS AND TOXICODYNAMICS WITH ZINC IN SOME TISSUES OF NILE TILAPIA, *OREOCHROMIS NILOTICUS*

Presented by

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To

My Parents & Brother

Acknowledgement

First of all pray full thanks to merciful **ALLAH** for the power endurance and everything, **ALLAH** gave me throughout my life.

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APPROVAL SHEET

Title of the M. Sc. Thesis

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Abstract

In the present work, the estimated median lethal dose (LD_{50}) of zinc (Zn), in Nile tilapia, *Orechromius niloticus*, at 24 hrs was 860.4 mg/ kg b. wt, whereas those of cadmium (Cd) in absence and presence of 180 mg Zn were 53.39 and 93.94 mg/ kg b. wt, respectively. The hepatic, renal, intestinal, gill filamentous and muscular Cd residue in fish intramuscularly injected with a single dose of 2.7 mg Cd only were higher than those injected with 2.7 mg Cd in combination with 43 mg Zn and controls at all the corresponding experimental periods (1, 3, 7, 14, 28 and 45 days). Cd induced some behavioral disturbance, in comparison to the control, represented in a heavy mucus secretion, violent abnormal up and down swimming, accelerated ventilation rate, bending of the body, loss of appetite and aggressive mode.

The toxicokinetics (total area under curve, AUC_{tot}; total area under the first moment curve, $AUMC_{tot}$; elimination half-life time, $t_{1/2}$**,** mean residence time, MRT, total clearance from the tissue, Cl; elimination rate constant, Lz, maximum time, T_{max}, to reach maximum concentration, C_{max}; and the starting concentration, C_0) and toxicodynamics of Cd in the liver, kidney, gill filaments, intestine and muscle of *O. niloticus*, and their modulation with Zn throughout 1, 3, 7, 14, 28 and 45 days post-intramuscular injection with a single dose of 2.7 mg Cd (≡ 1/20 Cd LD_{50}) only or in combination with 43 mg Zn (≡ 1/20 Zn LD_{50}) /kg b. wt were studied. Administration of Zn in combination with Cd caused significant decrease in AUC_{tot}, $AUMC_{tot}$, $t_{1/2}$, MRT but markedly increased Cl and Lz of Cd when compared with those administered Cd only.

The hematological (RBCC, Hb, Hct, MCV, MCH and MCHC), biochemical parameters (the concentration of glucose, urea, uric acid, creatinine and activities of AST & ALT in serum and the hepatic glycogen content), the growth indices (K and HSI) and the histological changes in the studied tissues (gill filament and liver) didn't affected by the accumulated Cd, except at its C_{max} in fish treated with Cd only. In conclusion, Zn has the ability to ameliorate the toxicity of Cd by the reduction of its accumulation and toxicokinetics parameters in tissues of fish.

Key words: Cd, Zn, LD_{50}, accumulation, toxicokinetics, *O. niloticus*, AUC_{tot}, $AUMC_{tot}$, $t_{1/2}$, MRT, Cl, Lz.

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List of abbreviations

Abbreviation	
Cd	Cadmium
Zn	Zinc
LD_{50}	Median lethal dose
AUC_{tot}	Total Area under curve of time versus concentration
$AUMC_{tot}$	Total Area under first moment curve
$t_{1/2}$	Elimination half-life time
Lz	Elimination rate constant
MRT	Mean residence time
Cl	Total clearance of toxicant from tissue
C_0	Starting concentration
C_{max}	Maximum concentration of toxicant
T_{max}	Maximum time at which maximum concentration of Cd was reached
S.S.	Sum of Squares
d.f.	Degree of Freedom
M.S.	Mean Square
F_{cal}	$F_{calculated}$
RBCC	Red blood cell count
Hb	Hemoglobin content
Hct	Hematocrit value
MCV	Mean corpuscular volume
MCH	Mean corpuscular hemoglobin
MCHC	Mean corpuscular hemoglobin concentration
AST	Aspartate aminotransferase
ALT	Alanine aminotransferase
GL	Gill lamellae
IL	Interlamellar cells
Pc	pillar cell
LB	lamllar blood sinus
Ed	edema
EL	epithelial lifting
Hc	Hepatic cell
S	Hepatic blood sinuses
Nu	nucleus of hepatocyte
Co	blood sinuses congestion
V	Vacuoles
DCHB:	3,5-dichloro-2-hydroxybenzene sulfonic acid
LSD	Least significant differences
ANOVA	One way analysis of variance
MANOVA	Multivariate analysis of variance

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TO WHOM IT MAY CONCERN

This is to certify that **Atef Abd El-Moneim Ali,** has attended and passed successfully the following Postgraduate Courses as a Partial Fulfillment of the requirements of the degree of Master of Science (**Ecology, 2006/2007**).

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