Ain Shams University
Faculty of Women for Art,
Science and Education
Zoology Department

Improvement of the efficiency of praziquantel by *Citharexylum quadrangular* extract and micronutrients in murine schistosomiasis

Thesis
Submitted for Fulfillment of the Ph.D. Degree of Science in Zoology
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Abstract

Despite effective chemotherapy, schistosomiasis remains the second major public health problem in the developing world, second to malaria. The present study was undertaken to improve the efficiency of PZQ against *S. mansoni* and its complications using some micronutrients (vitamin E and selenium) and chloroform extract of *Citharexylum quadrangular* leaves and their mixture. This was achieved through prophylactic and therapeutic treatments of *S. mansoni* infected mice with these agents in combination with PZQ compared with treatment of PZQ only. The present work was also extended to evaluate the effects of these micronutrients and plant extract against *S. mansoni* infection and its complications without PZQ. Parasitological and biochemical markers showed that the prophylactic and therapeutic treatments of infected mice with the current supplements in combination with/or without PZQ treatment improved all the investigated parameters. The prophylactic treatments of infected animals with the studied agents in combination with PZQ were more effective in improving parasitological parameters as well as biochemical one than PZQ alone. In conclusion, the combination with the studied supplements and PZQ improved the efficiency of PZQ on one hand. On the other hand, studied agents are very effective in attenuating the oxidative insult associated with *S. mansoni* infection.

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List of Abbreviations

AIDS	: Acquired immune deficiency syndrome
ALT	: Alanine aminotransferase
ANOVA	: Analysis of variance
AP-1	: Activated protein-1
AST	: Aspartate aminotransferase
B.C.	: Before christ
B. wt	: Body weight
CAT	: Catalase
CCl_4	: Carbon tetrachloride
CDI	: Cluster of differentiation 1
CNS	: Central nervous system
DNA	: Deoxyribonucleic acid
DTNB	: 5,5 Dithiobis -2- nitrobenzoic acid
ECM	: Extracellular matrix
ECMPs	: Extracellular matrix proteins
EDTA	: Ethylene diamine tetra acetic acid
ELISA	: Enzyme linked-immuno-sorbent assay
ER	: Ehrlich's reagent
ext.	: Extract
FA	: Fructosamine
FAD	: Flavin adenine dinucleotide
Fig.	: Figure
g /dl	: Grams per deciliter
GGT	: Gamma glutamyl transferase
GPx	: Glutathione peroxidase
GR	: Glutathione reductase
GSH	: Reduced glutathione

GSSG : Oxidized glutathione
GSTs : Glutathione transferases
H&E : Hematoxylin and eosin
H_2O_2 : Hydrogen peroxide
HCV : Hepatitis C virus
HIV : Human immunodeficiency virus
HSCs : Hepatic stellate cells
IgE : Immunoglobulin E
ICAM-1 : Intracellular adhesion molecule 1
IFN-γ : Interferon-γ
IL-10 : Interleukin-10
IL-6 : Interleukin-6
LD_{50} : Half lethal dose
LPO : Lipid peroxidation
LSD : Least significant difference
MAPs : Multiple antigenic peptides
MDA : Malondialdehyde
MoH : Ministry of Health
MoHP : Ministry of Health and Population
NAD : Nicotinamide adenine dinucleotide
NADH : Nicotinamide adenine dinucleotide reduced
NADPH : Nicotinamide adenine dinucleotide phosphate reduced
NADP : The oxidised form of NADPH
NBT : Nitro-blue tetrazolium
NED : N-1-naphthylethylenediamine dihydrochloride
NF-κB : Nuclear factor κ-B
NTDs : Neglected tropical diseases
NO : Nitric oxide

iNOS : Inducible nitric oxide synthase
$O_2^{\cdot -}$: Superoxide anion
O.D. : Optical density
ONOO̅ : Peroxynitrite
p value : Probability- value
PBMC : Peripheral blood mononuclear cells
Pg : Pico gram
PZQ : Praziquantel
RNS : Reactive nitrogen species
ROS : Reactive oxygen species
r.p.m. : Revolutions per minute
S. : *Schistosoma*
SCID : Severe combined immunodeficient
Se : Selenium
SEA : Soluble egg antigens
SmMLC : *S. mansoni* myosin light chain
SOD : Superoxide dismutase
sp. : Species
SWA : Schistosome adult worm antigens
TBA : Thiobarbituric acid
TBAS : Thiobarbituric acid reactive substance
TCA : Trichloroacetic acid
TGF-β : Transforming growth factor-β
Th1 : T helper 1
Th2 : T-helper 2
TMB : Tetramethylbenzidine
TNF-α : Tumor necrosis factor-α
TrxR : Thioredoxin reductase
α-TTP : α-Tocopherol transfer protein

Vit. E : Vitamin E

WHO : World Health Organization

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