RADIOPROTECTIVE PROPERTIES OF 50% WATERMELON JUICE AGAINST LOW DOSE IONIZING RADIATION (LDIR)-INDUCED OXIDATIVE STRESS IN LUNG

By

ANISAH BINTI ABD RASID

Thesis Submitted in Partial Fulfillment for the Degree of Bachelor of Medical Laboratory Technology (Hons), Faculty of Health Sciences; Universiti Teknologi MARA

2015
DECLARATION

“I hereby declare that this thesis is based on my original work and has not been submitted previously or currently for any other degree at UiTM or any other institutions.”

........................................
ANISAH BINTI ABD RASID
920411-11-5884
2011272134
ABSTRACT

Radioprotective Properties of 50% Watermelon Juice against Low Dose Ionizing Radiation (LDIR)-Induced Oxidative Stress in Mice Lung

Low dose ionizing radiation (LDIR) may trigger oxidative stress which leads to generation of free radicals. There is lack of information about the capability of watermelon as a natural antioxidant that helps to scavenge LDIR-induced free radicals. This study was conducted to determine the radioprotective properties of 50% watermelon juice on biochemical and molecular changes against LDIR-induced oxidative stress in mice lung. A total of 18 ICR male mice were randomly divided into three groups (n=6); negative control group, radiation group and treatment group. Mice in negative control and radiation group were given filtered tap water while treatment group was supplemented with 50% watermelon juice for 14 days ad libitum. Mice in radiation and treatment group were then exposed to 100 µGy x-ray whole body irradiation on day 15. Liver tissues were excised immediately and assessed for the superoxide dismutase (SOD) activity (inhibition %), total glutathione (GSH), malondialdehyde (MDA) and DNA damage (Comet Assay). SOD activity (inhibition %) showed no significant difference between all groups. Treatment group showed increment SOD activity (inhibition %) compared to negative control and radiation group. GSH level in lung tissues showed significant diminish in radiation group versus negative control group (\(p < 0.001\)). Treatment group showed significant depletion in GSH level compared to negative control group (\(p < 0.001\)). MDA levels showed significant increment in treatment group compared to negative control group (\(p < 0.005\)). DNA damage of lung tissues in radiation group showed significant increased compared to negative control (\(p < 0.001\)). While treatment group showed significant decreased in DNA damage compared to radiation group (\(p < 0.001\)). In conclusion, this finding may postulate that radioprotective properties of 50% watermelon juice against LDIR-induced oxidative stress which supplemented to the mice for 14 days may reduce DNA damage but may be not give sufficient enough effect to biochemical changes in lung tissue.

Keyword: watermelon; low dose ionizing radiation (LDIR); DNA damage; oxidative stress.
TABLE OF CONTENTS

DECLARATION ii
ACKNOWLEDGEMENT iii
TABLE OF CONTENTS iv
LIST OF TABLES vii
LIST OF FIGURES viii
LIST OF ABBREVIATIONS ix
ABSTRACT x

CHAPTER 1 INTRODUCTION 1

1.1 Background 1
1.2 Problem Statement 2
1.3 Significance of Study 3
1.4 Research Objectives 4
   1.4.1 General Objectives 4
   1.4.2 Specific Objectives 4
1.5 Hypothesis of the Study 4

CHAPTER 2 LITERATURE REVIEW 5

2.1 Radiation 5
   2.1.1 Definition and Applications of Radiation 5
   2.1.2 Ionizing Radiation (IR) 6
   2.1.3 Low-Dose Ionizing Radiation (LDIR) 6
2.2 Radiation-induced oxidative damage 7
   2.2.1 Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS) 7
   2.2.2 Radiation-induced oxidative stress 8
   2.2.3 Radiation-induced DNA damage 10
   2.2.4 Detection of DNA damage using Comet Assay 12
2.2.5 Radiation-induced oxidative stress in lung 12

2.3 Oxidative stress biomarkers 14
2.3.1 Lipid peroxidation (Malondialdehyde) 14

2.4 Antioxidant 15
2.4.1 Definition of antioxidant 15
2.4.2 Superoxide Dismutase (SOD) as enzymatic antioxidant 17
2.4.3 Glutathione (GSH) as non-enzymatic antioxidant 19
2.4.4 Watermelon as antioxidant 20

CHAPTER 3 MATERIALS AND METHODS 23

3.1 Materials 23
3.1.1 Chemicals 23
3.1.2 Consumables 24
3.1.3 Equipment and Instruments 25

3.2 Methods 26
3.2.1 50% watermelon juice preparation 26
3.2.2 Animal handling and watermelon juice treatment 26
3.2.3 Low dose X-ray radiation 27
3.2.4 Animal cervical dislocation 27
3.2.5 Superoxide Dismutase (SOD) Assay 28
3.2.6 Glutathione (GSH) Assay 30
3.2.7 Malondialdehyde (MDA) assay 33
3.2.8 Comet assay 35
3.2.9 Statistical analysis 38

CHAPTER 4 RESULT 40

4.1 Determination of SOD Activity (Inhibition %) 40
4.2 Determination of Total Glutathione (GSH) Level 41
4.3 Determination of Malondialdehyde (MDA) Level 42
4.4 Determination of DNA Damage (Comet Assay) 43
4.4.1 Qualitative of DNA Damage 43