



UVC Radiation Effect on DNA and Protein in Mice

Abu Bakr El-Bediwi¹, El-Sayed Kamel Areida², Eman Eid

¹Physics Department, Faculty of Science, Mansoura University, Egypt

²Zoology Dept., Faculty of Science, Mansoura University, Egypt

Abstract

UVC radiation act positively and negatively on the immune system such as induces cancer and takes part in the production of vitamin D. This work is studied the effect of UVC on DNA and protein. The results show UVC radiation increased DNA expression in cells. UVC radiation caused a significant increase of DNA synthesis phase in cells and apoptosis in it. UVC radiation caused a significant increase in cell cycle synthesis phase in cells. UVC radiation caused a significant increase in cell cycle arrest at G₀/G₁ in cells. UVC radiation caused a significant increase in pattern and amount of protein synthesis in cells exposed to UVC.

Keywords: DNA, Protein, UVC radiation, Cell cycle arrest

Corresponding author: Abu Bakr El-Bediwi

Physics Department, Faculty of Science, Mansoura University, Egypt.

E-mail: baker_elbediwi@yahoo.com

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Introduction

Radiation is energy in the form of waves or streams of particles. There are many kinds of radiation around us. People think that, the word radiation is atomic energy, nuclear power and radioactivity. Radiation has many other forms. Sound and visible light are familiar forms of radiation; other types include ultraviolet radiation, infrared radiation, radio and television signals. Today, radiation refers to the whole electromagnetic spectrum as well as to all the atomic and subatomic particles that have been discovered. Biological effects of UV radiation and light can be classified as either direct effects or indirect effects. Direct effects are those for which the biological alterations take place in the tissue where the photons are absorbed. Indirect effects are those for which signals are transmitted from the organ or tissue where the photons are absorbed via nerves, hormones or other molecules to the organ where the biological effect is manifested. Though biological effects of UVA and UVB radiations have been studied on several animal

species [1-9] but the effects of UVC radiation are poorly studied. UVC radiation has harmful effects on skin and eye in mice and the recovery were found insignificant [10]. Also an obvious change in the general behavior movement with a significant effect in blood mice structure after exposure to UVC radiation [11]. No more research available covered the effect of UVC radiation, therefore the aim of this research is to study the effect of ultraviolet-c radiation on DNA, protein and cell cycle regulatin in male mice and the recovery possibility.

Materials and Methods

Animals

In this study total of 80 male mice, weighing 20-25 g are divided into four main groups:

1. Control mice group (A): Normal animals.

2. UVC-irradiated mice group (B & C):

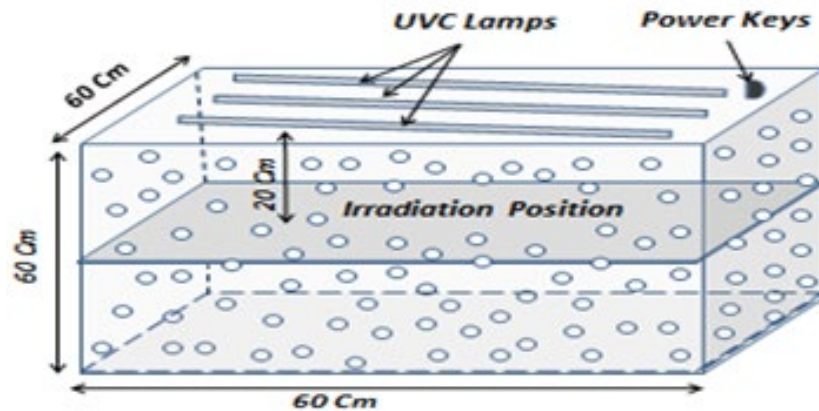
B: Animals constantly exposed to UVC-radiation (1hour daily) for one month

C: Animals constantly exposed to UVC-radiation (2hour daily) for one month.

3. ecovery group (D): Recovery animals after constantly exposer to UVC-radiation (2 hour daily) for one month.

Irradiation facilities

The mice were placed in a special wood box (60x60x60 cm) have many small holes in sides to enable the mice to alive during the experiment of irradiation as shown in Figure 1. Three "Sylvania G15W" ultraviolet lamps in 15 Watt powers for each one and in 45 cm length were placed to the internal top surface of the wood box. These lamps consist of a tubular glass envelope and emit more than 85% of their energy in the UVC ultra violet radiation with a peak at 253.7 nm for germicidal action [6]. Shape, electrical characteristics and lighting circuits are similar to general fluorescent lamps. The majority of germicidal lamps operate most efficiently in still air at an ambient temperature of 25°. All lamps are ozone free. A protective coating on the inside of the lamp limits the depreciation of the UVC output.



Figur1: special wood box, where the mice are exposed to UVC radiation

Experiments are performed on mice at the animal house of Biophysics Department, Faculty of Science, Mansoura University, Egypt, under conventional laboratory conditions. All animals in control and experimental group are housed collectively in polycarbonate cages 30x40x40 cm (W x L x H) and given access to standard laboratory food and water. Mice are classified into four groups: control and three UVR-treated groups. Mice are exposed to UVC radiation 1hour daily (group B) and 2 hour daily (group C & D) for one month. The dose delivered to the mice were calculated and adjusted at 20 cm from the lamps in the middle of the irradiation shell in order to be sure that all the mice receive a uniform and homogenous field of irradiation. A timer was used to standardize UVC exposure times.

Method

Following the end of exposure and post exposure periods autopsy samples are taken from the skin and eyes of mice in different groups

and fixed in 10% formol saline for twenty four hours. Washing is done in tap water then serial dilutions of alcohol (methyl, ethyl and absolute ethyl) are used for dehydration. Specimens are cleared in xylene and embedded in paraffin at 56 degree in hot air oven for twenty four hours. Paraffin bees wax tissue blocks are prepared for sectioning at 4 microns thickness by slidge microtome. The obtained tissue sections are collected on glass slides, deparaffinized and stained by hematoxylin and eosin stain for examination through the light electric microscope ^[12].

Results and discussion

Effect of UVC radiation on DNA in male mice

Figure 2 shows DNA expression in cells for male mice before and after exposure to UVC radiation from ultraviolet lamps. UV increased DNA expression in cells lane 1 Marker, lane 2 exposure to UV for one hour for a duration of one month, lane 3 control, lane 4 exposure to UV for two hours for a duration of one month, lane 5 after recovery.

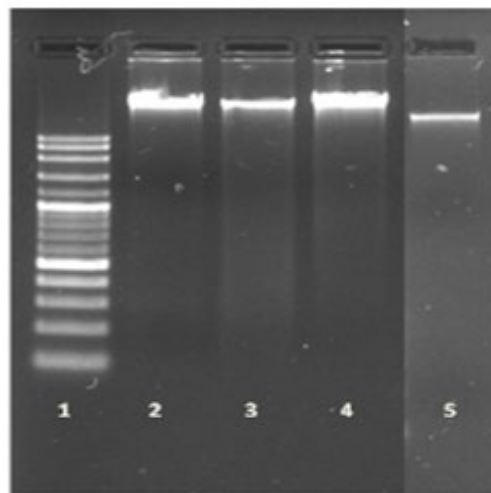


Figure 2: DNA expression

Figure 3 shows cell cycle analysis for male mice before and after exposure to UVC radiation. UV induced a significant increase in apoptosis in cells exposed to UV for one hour for duration of one month, cells exposed to UV for two hours for duration of one month and after recovery. UV induced a significant increase cycle arrest at

Go/G1 phase in cells exposed to UV for one hour for a duration of one month, cells exposed to UV for two hours for a duration of one month and after recovery compared to controls. Also UV induced a significant increase of DNA synthesis phase in cells exposed to UV for one hour for a duration of one month, cells exposed to UV for two hours for a duration of one month and after recovery compared to controls.

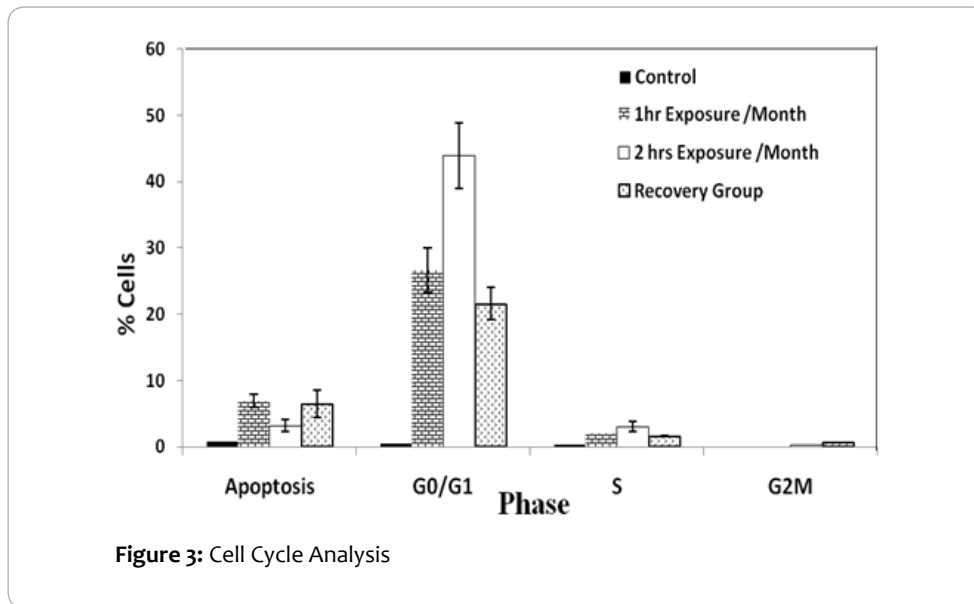
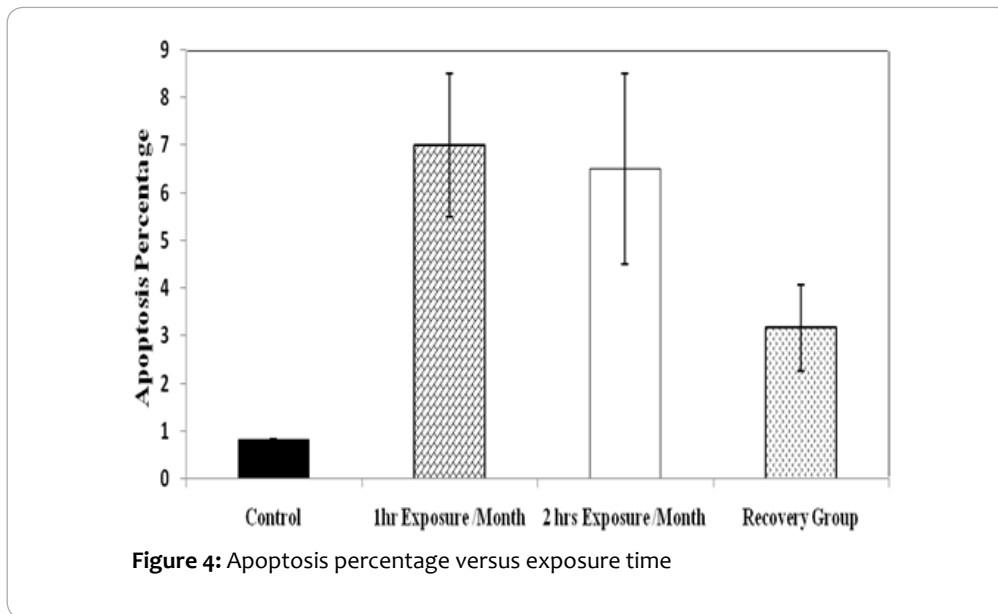


Figure 4 shows apoptosis in cells for male mice before and after exposure to UVC radiation. UV radiation induced a significant increase

in apoptosis in cells exposed to UV for one hour, two hours during one month and after recovery compared to controls.



Cell cycle arrest at Go/G1 in cells for male mice before and after exposure to UVC radiation from ultraviolet lamps is shown in Figure 5. UV induced a significant increase in cell cycle arrest at Go/G1 in cells

exposed to UV for 1 hour, 2 hours during one month and after recovery compared to controls. Cell cycle arrest at Go/G1 was significantly higher in cells exposed to UV for two hour compared to for one hour.

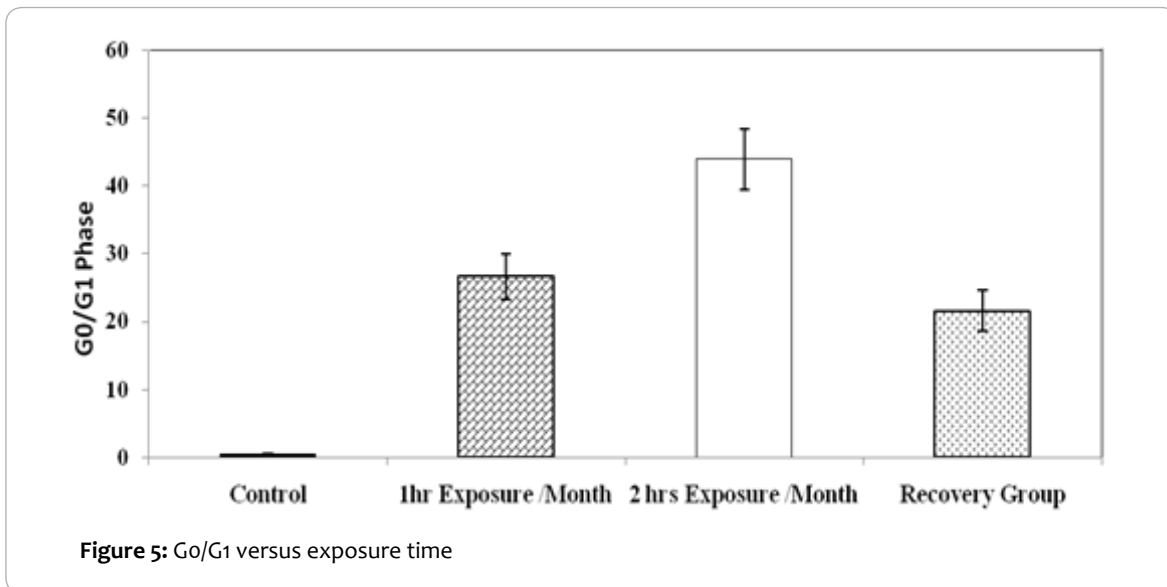


Figure 5 shows cell cycle synthesis phase in cells for mice before and after exposure to UVC radiation. UV induced a significant increase in cell cycle synthesis phase in cells exposed to UV for one hour, two hours for a duration of one month and after recovery compared to controls.

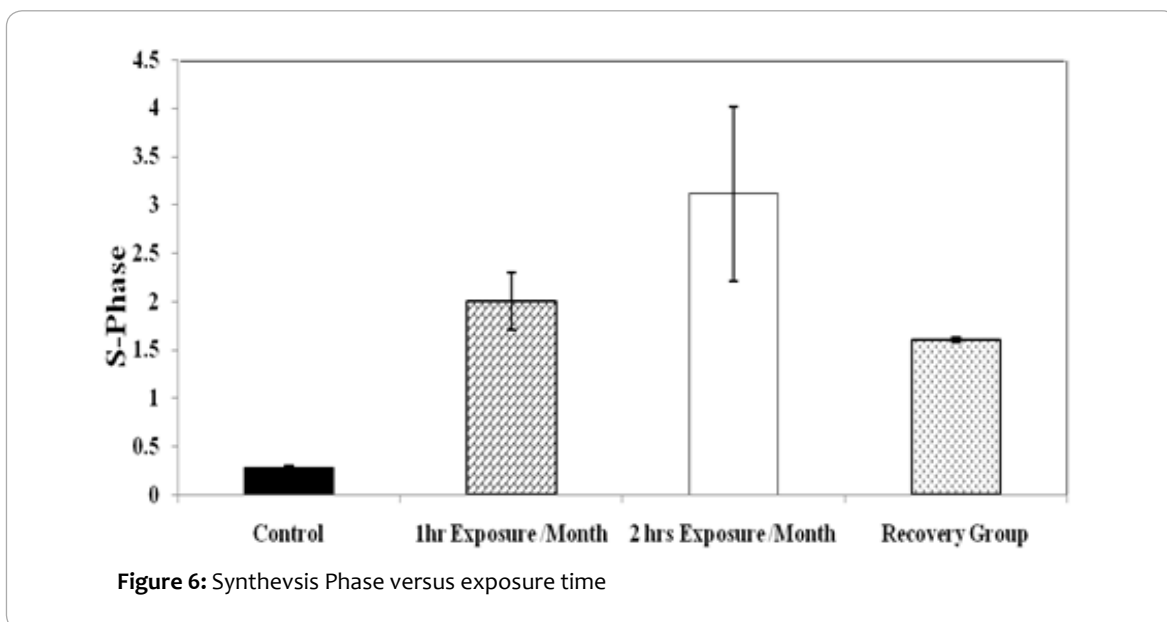


Figure 6 shows cell cycle at G₂/M phase in cells for male mice before and after exposure to UVC radiation from ultra-violet lamps. A significant increase in cell cycle at G₂/M phase in mice cells exposed to UV for one hour, two hours and after recovery compared to controls.

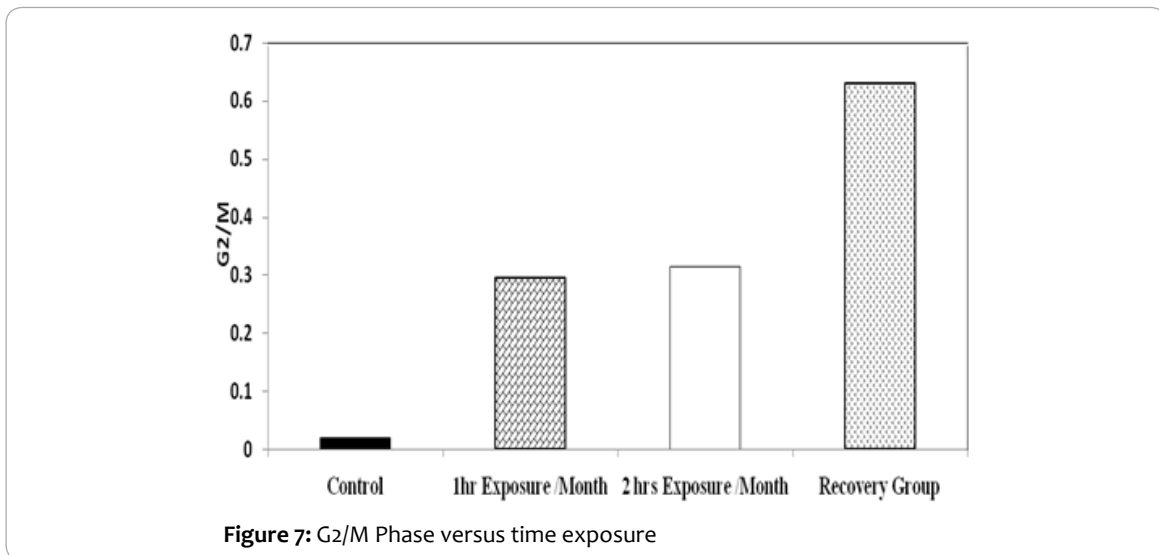


Figure 7: G2/M Phase versus time exposure

Protein synthesis in cells for male mice before and after exposure to UVC radiation is shown in Figure 8. Ultra-volute C induced a significant

increase in pattern and amount of protein synthesis in cells exposed to UV for one hour, two hours and after recovery.

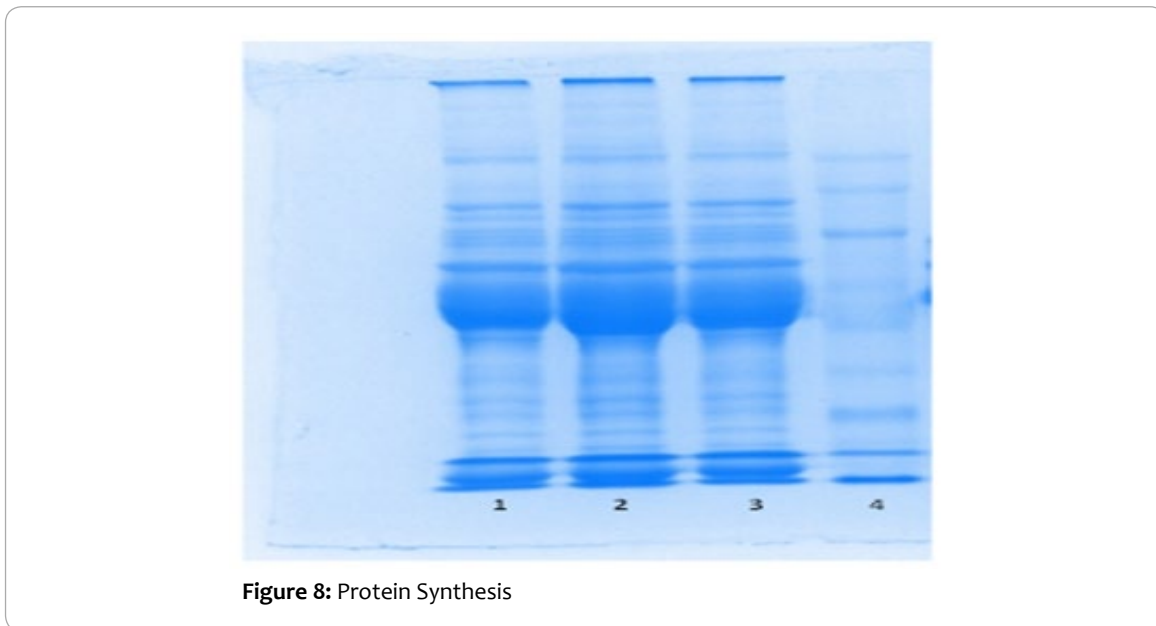


Figure 8: Protein Synthesis

Conclusion

UVC radiation have a significant effect on DNA expression in cells, cell cycle synthesis phase in cells, cell cycle arrest at G₀/G₁ in cells, pattern and amount of protein synthesis in cells.

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