

ORIGINAL RESEARCH ARTICLE

**RBC Response in Mice to Low Level Gamma Irradiation and Their Protection by Liv.52**

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**ABSTRACT**

The present study aims to investigate the role of Liv-52 as a radio protector in male albino rats against hematological injury induced by gamma radiation. Radioprotection was evaluated by the ability of Liv 52 to reduce the lethality produced by cobalt-60 gamma radiation. Mice were treated by oral gavage once daily for seven consecutive days with Liv 52 (500 mg/kg body weight) prior to radiation. Male Swiss albino mice were exposed to 1 and 3 Gy of whole-body gamma irradiation in the presence (experimental) and absence (control) of a herbomineral formulation of Liv.52. Quantitative variations in the number of red blood cell count were scored in peripheral blood at various time intervals between on the day of exposure to 28 days. At 1Gy dose, depression in RBC was noticed till 24 hrs, whereas in higher doses until day 3 with a sharpness in first 24 hrs. Prior administration of Liv.52 significantly prevented the depletion of RBC count and initiated recovery towards normal at 07 days in experimental animal. The behavior of RBC shows decline on day 1 but start recovering gradually further days. On 3 GY extent of depletion of RBCs observed prominently on 12 hrs after irradiation but in drug treated group shows gradual increase and initiated recovery at day 7. It is noted that liv 52 decreases the direct cell killing against gamma radiation may be due to by increasing the cellular glutathione (GSH) level<sup>[16]</sup> and restores early recovery of RBCs in drug treated animal.

**Keywords:** Red Blood Cells, Mice, Liv.52, Gamma Rays, Radioprotection

**INTRODUCTION**

Radiotherapy has become a routine treatment for various types of malignancies. Severe adverse side effects commonly arise from radiotherapy. Exposure to ionizing radiation represents a genuine, increasing threat to human being and our environment. The Steadily increasing applications of radiation in clinical practice, industrial and agricultural activities, have a measurable impact contributing to possible radiation hazards in humans. Control of radiation hazards is considered as one of the most important challenges in order to protect our lives from radiation damage.

Irradiation is well known to have a destructive effect on lymphoid and hematopoietic tissues. Depletion of the cellular elements of the blood was reported<sup>[16]</sup>. The effect of irradiation on bone marrow lymphocytes and erythropoietic cells as well as blood lymphocytes of the rat have been studied. Lymphocytes were found to be

particularly radiosensitive and their depletion is associated with a reduced immune response<sup>[10]</sup>.

Development of effective radio protectors and radio recovery drugs is of great importance in view of their potential application in radiotherapy and unplanned radiation exposure (i.e., in the nuclear industry, natural background radiation). Extensive research has been carried out in recent years to find a suitable chemical radio protective agent, which can be administered safely before radiation exposure. Several chemical compounds like cystein, cysteamin, 2-mercaptopropionyl glycine have been known to afford a high degree of protection against radiation in mammals, but most of them were found toxic at their optimum protective dose level<sup>[5]</sup>. Liv.52 was revealed to be a non-toxic, hepatoprotective as well as radio protective drug<sup>[3,9,12]</sup>. This study has done to investigate the protective efficacy of this drug against radiation-

induced quantitative variations in differential leucocytes count of peripheral blood in mice [6-8].

## MATERIALS AND METHODS

### Animals

Young adult male Swiss albino mice of 6-8 weeks age weighing about  $22 \pm 2$  gms were selected from a closely bred colony maintained on standard mice feed (procured from Hindustan Lever Ltd., India) and water *ad libitum*. The selected mice were divided in two different groups. One group of animals was orally given a 5% dextrose solution once a day for 7 days before irradiation to serve as control while the other group received 500 mg/kg body weight of Liv.52 powder (The Himalaya Herbal Drug Co. Mumbai) dissolved in 5% dextrose solution in a similar manner to serve as experimental group.

### Irradiations

One hour after administration on day 7, the animals of both control and experimental groups were exposed to two different sub lethal doses (1 Gy and 3 Gy) of gamma radiation. The animals were whole-body exposed to gamma radiation by Cobalt teletherapy unit (Co-60) source (dose rate= 1.16 Gy/min) at a distance of 80 cm, at the Radiotherapy Department, Sushrutha Cancer Hospital, Karimnagar. A.P. All these groups were observed daily up to 28 days for any sign of sickness, behavioral toxicity and mortality. The animals were autopsied on days 12hrs, 1, 3, 7, 14 and 28 post-irradiation intervals for the study of hematological parameters.

### Hematological study

Blood sample was collected from the orbital sinus of mice from respective groups, in a vial containing 0.5 M EDTA. The number of Red Blood Cell (RBC), were determined by adopting standard procedures

### Statistical analysis

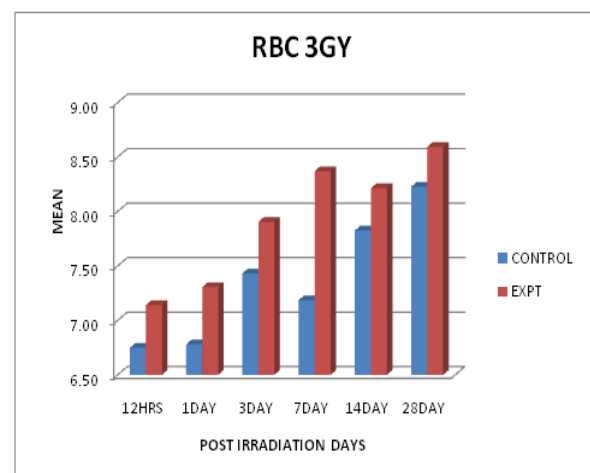
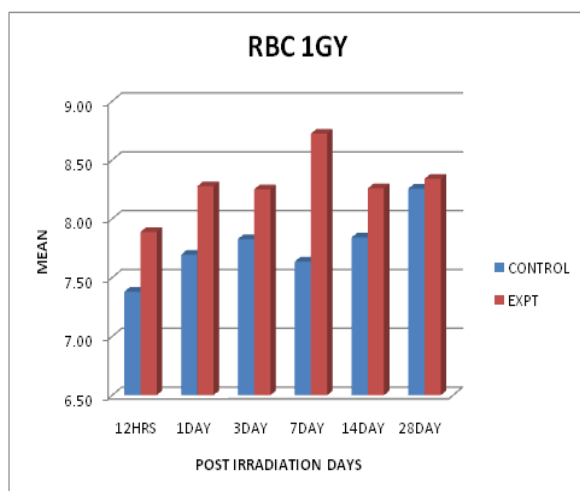
The Students't' test was used for statistical comparison between the groups and significance level was set at different levels as  $p < 0.05$ .

### RESULTS

The results obtained from the present investigation are depicted in the (Table 1). The RBCs in general showed an initial decline after irradiation in both the dose level used. The depletion in count was more rapid during first 12 hours; thenceforth it increased slowly till day 28 in both control and experimental groups at 1 Gy dose. The normal RBC count restored in both the groups on day 7. However, depression was less marked in drug treated animals and a significant protection was observed at later intervals in 1 Gy and 3 Gy dose rates (Table 1). At 3 Gy, the RBC count depleted till day 1 but the drop was as high 40 percent of normal (Table 1). The percentage of RBCs showed gradual increase from day 1 but the normal could be restored on day 7 in both control and experimental animals. A significant protection in RBCs was registered throughout the time intervals.

Table 1: Present investigation report

Irradiation Dose (in Gy)	Type of leucocytes	Mode of Treatment	Post-Irradiation Time (In days)					
			12 hrs	1-day	3-day	7-day	14-day	28-day
1 GY	RBC	CONTROL	7.38± 0.05	7.70± 0.04	7.83± 0.02	7.64± 0.06	7.84± 0.02	8.26± 0.01
		EXPERIMENTAL	7.89± 0.05	8.28± 0.02	8.25± 0.04	8.72± 0.07	8.26± 0.04	8.34± 0.01
3 GY	RBC	CONTROL	6.75± 0.03	6.78± 0.11	7.43± 0.02	7.19± 0.05	7.82± 0.02	8.23± 0.01
		EXPERIMENTAL	7.14± 0.03	7.30± 0.02	7.90± 0.05	8.37± 0.08	8.21± 0.04	8.59± 0.01
		p-Value	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05



**DISCUSSION**

In the present experiment, irradiation with lethal doses of gamma rays brings about a reduction in the level of the red blood cells in early time interval but could recover further time intervals. This supports the earlier findings who reported that after 20 days of low dose gamma exposure RBCs could recover to its close normal levels <sup>[16]</sup>. In the present study the lower RBC count may be due to defective haemopoiesis as well as intravascular red cell damage <sup>[12]</sup>. In addition, the shortening of life span of erythrocytes by radiation suggested <sup>[16]</sup>, may have significant role in bringing depletion in RBC. It is an established fact that the depletion in the various blood component is largely due to the adverse effect of radiation on blood forming organs <sup>[16]</sup>. When bone marrow became totally aplastic and its proliferative capacity is reduced by heavy radiation then stem cells of the spleen start dividing and differentiating in to erythroblast to compensate the peripheral blood cell loss.

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