…….…… ABSTRACT ……..…

White blood cells are the fundamental viable defense barrier in the body immune system which are capable of impairing and killing any intruder using plenty of potentials One is the capacity to generate reactive oxygen species (ROS), like hydroxyl radical (OH*) and singlet oxygen (O_2^1). The generation of these chemically highly reactive molecules is a result of respiratory activation in white blood cells (WBCs). Gamma rays are a type of ionizing radiation that presents naturally and artificially, contributing for a large amount of the living body background exposure. Such radiation will produce free radicals from the excitation reactions of compounds, especially water. The somatic damage of radiation maybe tolerated if whole body exposure was in a low rate and extended over a long period of time. Sensitivity, resistance and reactive activity of WBCs will react differently to gamma radiation according to their characteristics and body repair mechanisms.

The phagocytic activity and the respiratory burst of WBCs were assayed using luminol amplified-Chemiluminescence (LA-CL) of whole blood using an ultra-sensitive multi purpose photon counting system using small volumes of diluted whole blood. The induced chemiluminescence signals were acquired, graphed and interpreted to give a clear statistical view about WBCs kinetics and interactions. The CL measured reactive activity of WBCs was affected by the number of WBCs in the diluted blood. For irradiation experiments a typical Geiger-Muller (G.M.) tube counter was used and calibrated using standard dose rate meters. For mice irradiation, a heavy shielded radioactive source brought and identified. Using the previously calibrated devices, exposure rates and absorbed dose profile were established. Two BALB/c mice groups were used, a control shielded from radiation, and irradiated was put for the calculated period to accumulate the dose. Mice were dissected for blood and bone marrow collection. Assays were done concerning viability, total and differential blood counting, chemiluminescence assays were done on whole blood to verify

WBCs total reactive activity, reaction time, peak activity and peak reaction time values. Also calculated is the single WBC activity. CL- assays were done on bone marrow to evaluate, the total reaction time, peak activity values, and the reactive activity per micro-liter unit. In total the results proved the sub-lethal significant effects of radiation on total and differential WBCs counts and function with great effects on neutrophils and lymphocytes. The sensitization threshold of each cell type was unique and for all it laid in the 1Gy- scale absorbed dose. Lymphocytes were comparatively resistant and showed high tolerance than neutrophils toward the 1Gy-scale. Monocytes sensitization and tolerance was higher than eosinophils and basophils, which collapsed earlier in the low dose range (1.25 Gy). Monocytes, neutrophils and lymphocytes all contribute for the leukemia state developed by the long term irradiation period of mice. Analysis of sub-types of neutrophils and lymphocytes showed that ring-shaped nucleus neutrophils and small nucleus lymphocytes increased in count upon irradiation and were highly resistant than the other sub-types.

CL analysis carried on bone marrow revealed that sensitization takes place first in the haemopoietic compartment in the early low level doses and bone marrow compensates by over production of immature (defective) WBCs types. A wide tolerance was present at the 1st Gy and 2nd Gy-scale absorbed doses, with a maximum peak in LD-50 dose range. While a threshold sensitization is evident earlier in the bone marrow micro-liter unit, tolerance collapsed upon reaching the 3rd Gy- scale.

In conclusion long term exposure to gamma radiation caused sub-lethal damage to the haemopoietic tissue along with peripheral blood cellularity changes, and the low doses gained the system adaptation and tolerance against previously sensitized dose levels. The whole blood and bone marrow CL assays are highly sensitive In Vitro procedures for the precise quantitative and qualitative analysis of WBCs illustrating their production, maturation and differentiation kinetics.