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# Effect of Gamma Radiation in Cellular Compound of Blood for Patients with Breast Cancer

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***Abstract***

*The effect of gamma radiation were studied in cellular components of blood within the human body for patient with breast cancer, who receive radiation therapy as part of the final stage requirement treatment for cancer.The current study (5-8) mm.of the venous blood have been drawn from the patient before starting their radiation treatment which considerd as control sample (zero Gray) .These sample used in order to compare with blood sample drawn from the same patient after every three sessions; mean every six gray dose of the gamma rays. The rang of gamma doses which recived by patients were (6,12,18,24,30,36,42,48,54,60) GY. Also the effect of gamma radiation measured to the total of hemoglobin (Hb), Mithamoglubin derivative (Met Hb%) ,the percentage of white blood cells (W.B.C%) and platlets (PL%) before and after radiation. The result appeared changes in these ratio as the total hemoglobin has been increased with radiation till dose (18) GY, this increases attributed to cross–linking phenomenom in polypeptide chain for protein in hemoglobin as aresult of affecting to low doses of gamma rays, but when the dose increased to (30) GY, an opposite behavior occurred, means that the total hemoglobin decreased with increasing dose till (36)GY then stable. The change in the percentage of Mithamoglupin derivative shown direct proportion with increasing radiation dose and this behavior attributed to the effecting of hem part in hemoglobin, which turn lead to asignificant decrease in the efficiency of the molecules that transfer oxgen. Our research explained the inverse relasionship between the percentage of white blood cells and platlets with radiation doses up to (36) GY . Also the decrement attributed to generation toxic chemical compounds which reach bone marrow, laded to discourage efficiency in the production of (W.B.C) and (PL).*

***Keywords:*** *Gamma radiation etc, Polypeptide chain etc.*

## 1. Introduction

Breast cancer in woman more commen disease recently and gamma ray radiation therapy is an integral part indispensable in treatment ,so that it was necessary to know the side effect of radiotherapy in patients and its more dangerous than the cancer itself. Radiation therapy including eliminate the remaining cancer cells by using gamma ray in order to prevent the spread of the disease [1] .Chemotherapy used in treatment just to delay the stages of cancer [2]. Blood consist of two part, first is serum (plasma) , secondly is cellar part which consisting from red blood cell (R.B.C), white blood cells (W.B.C) and platlets (PL) [3]. Red blood cells are disc-Shaped lost their nucleus quickly after configuration producing in the bone marrow, about 71% of these cells are water and 28% of them are hemoglobin (Hb). Hemoglobin is transport oxygen and food to all cells of the body tissue [4]. White blood cells contain different combinations (acid, base neutral…..etc) made in the bone marrow, the lymphocytes are responsible to protect the body from diseases. Platlets are cells with multi forms (asterisk. Oval, triangular……etc) consist of portion in nuclear protoplasm cell, they are small plucking from main large part formed in the bone marrow (Megakarocytic) these cells are combine to work as reimbursement in the injured sites to prevent bleeding, therefore its mainly responsible for the clotting [3]. Radiation effect in hemoglobin classify to direct effect and indirect effect. Indirect effect means that irradiation formed toxic chemical compounds which reach bone marrow and leads to reducing its activity, while direct effect means that irradiation effected directly in the constituent of polypeptide chain which leads to two possibilities, firstly; the cross –thinking phenomenon which causes the appearance of long chain protein with heavy molecular weight. Secondly breaking (fragmentation) protein chain forming small polypeptide with light molecular white [5]. In addition to all above, when hemoglobin exposure to any radiation will lead to ionize iron atom in hem part ( $Fe^{+2} \rightarrow Fe^{+3}$) which chainging Oxygenated hemoglobin ($Hbo_2$) to (Meth Hb) derivative [6].

## 2. Material & Methods

Blood Sample prepared from venous blood just drawn from patient with breast cancer ages between (30-45) years, who are receiving their radiation treatment in hospital of nuclear medicine in Baghdad. The highest dose range between (40-60) GY , for two gray per session radiotherapy. In mentioned hospital the system used for irradiation was (SHIMADZU) company, type (RTGS-21) with cobalt source ($^{60}Co$) ,card (1.25)Mev, and the system have apyramid plug which covers an area (30×30) $cm^2$ .The method of extraction absorbed radiation dose from human body by using phantom, which contain a tank component of sheets of Perspex with fixed size (30×30×30) $cm^3$ consist of material similar to tissue human body as density, atomic number and weights (70 kg) [7].

**1-**Blood sample prepared with draw (5-8) mm. of venous blood from patients before any exposure to radiation doses, then draw in glass tubes containing an anticoagulant (EDTA%).

**2-**Isolated (R.B.C.) separated from plasma by cooled centrifuge (3000 rpm)for (10) minutes then washed by sodium chloride solution (this process repeated three times) so that the solution has been analyzed by free ions distilled water as (1:10), the mixture leaved for (5) minutes to get a solution with concentration (20) mol. [8].

**3-**The total concentration of (Hb) measured by adding (0.02) ml. of blood which prepeard before, (5) ml. of potassium ferric cyanide solution, so that (Hb) will oxidized to (Meth Hb%) derivative , then interacts with cyanide to make mithamoglupin cyanide compound, which recorded the highest peak absorption at wave lengh (540 nm) by using absorption spectrometery device made by (pye Unicom) company [9].

**4-**The concentration of (Meth Hb%) derivative measured by adding (0.1)ml. of potassium ferric cyanide solution (the same concentration used in first paragraph) to (4)ml. of blood sample prepared before, then optical density of the solution will be measured at wave length (630nm), which record highest peak absorption by using the same spectrometer in first paragraph. The mathematical relation applied to calculate (Meth Hb%) as follow [10]:

$$\text{Meth Hb\%} = \frac{\text{O.D)630 Hb}}{(O.D)630\ MethHb}$$

$(O.D)_{630}$ Hb: Optical density of hemoglobin at wave length (630 nm).

$(O.D)_{630}$ Meth Hb: Optical density of mithamoglobin at wave length (630 nm).

**5-**The oncetration of (W.B.C.%) measured with draw blood sample of patients before starting their radiotherapy, these sample considered as control sample (Zero GY). (E.B.C.)measured by adding (0.02) ml. of mitigation solution of (W.B.C.) mixed well in order to prevent the destruction cells in a glass tube containing the anti- clotting substance, the mixture leaved for (6) minutes then dilute the solution and placed in a glass room (called nobar) by capillary tube, then coverd with slide of glass. The number of (W.B.C.) per liter of blood counted by using the optical microscope [5].

**6-**The concentration of (PL%) measured by adding (0.02) ml. of blood to (2) mm. of citric solution, the mixture leaved between (5-10) minute, then the number of platlets for one ml. will be counted by using the optical microscope [6].

## 3. Result and Discussion

**1-**The value of total hemoglobin significantly increased directly with increasing dose, when compared with control samples, appearing linear relationship between them till dose (18) GY, then completely reversed this relation and (Hb) began decrease with increasing dose till (36) GY, at this dose the stability occurred as shown in figure -1- This behavior attributed to low doses received by patients at the beginning radiotherapy treatment which caused the cross- linking phenomenon to polypeptide chain, that leads to increasing the molecular weight of hemoglobin protein and absorption which measured at wave length (540 nm). At the dose increasing more than (18) GY, an opposite phenomena occurred to polypeptide chain called fragmentation and thus will reduce the total concentration of hemoglobin caused anemia disease [5].

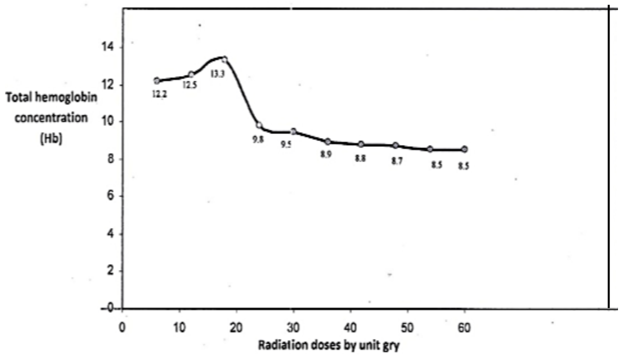


**Figure 1** Effect of gamma ray in total hemoglobin concentration (Hb) for breast cancer patient

**2-**The result show direct relation between (Meth Hb%) and dose, in fact these result unexpected because the effecting of radiation on hemigroub molecule causing the ionization of the iron atom ($Fe^{+3} \longrightarrow Fe^{+2}$) , so that decreasing in oxygenated hemoglobin ($Hbo_2$) concentration [3]. The increase in mithamoglobin certainly leads to reduce the amount of oxygen reaching to cells causing weakness to patient body [4], as shown in figure -2-, then (Meth Hb%) stopped increases at dose (36) GY.

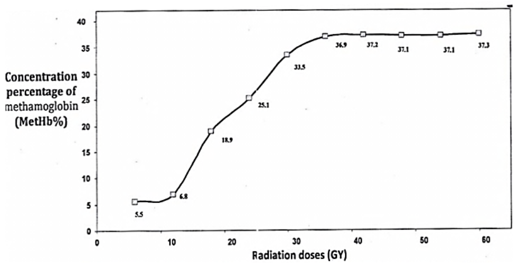


**Figure 2** Effect of gamma radiations concentration percentage of methmogloblin derivative (Met Hb%) for breast cancer patients

**3-** (W.B.C.%) and (PL%) measured personally depending on analysis of patients' blood according to periodical analysis that are measured in laboratories of hospital mentioned before. It is noted that (W.B.C.%) and (PL%) change inversely with increasing doses, then stabilized at dose (36) GY as shown in figures -3- & -4-.This result confirmed with previous studies [1,2] and the inverse relasionship for both them contributed to direct effect to the radiation which cause toxic chemical compounds due to ionizing water molecule inside the cells of human tissue and reached through the blood to bone marrow, so that the activity of marrow which response the production of (W.B.C.%) and (PL%) reduced [11, 12].

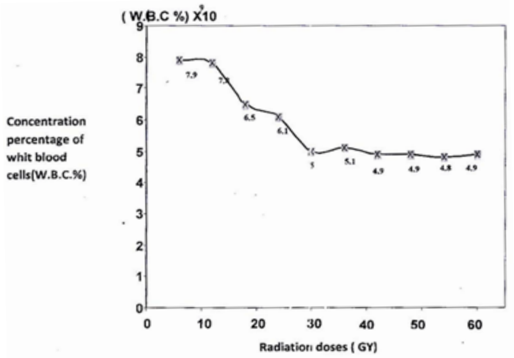


**Figure 3** Effect of gamma radiations concentration percentage of white blood cells (WBC %) for breast cancer patients

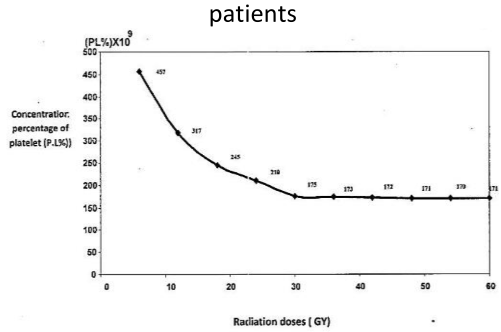


**Figure 4** Effect of gamma radiations concentration percentage of platelet (P.L%) for breast cancer patients

## 4. Conclusions

**1-**Low doses of gamma rays, limited between (2-18) GY considered non–hazard , especially these doses led to observable increase in hemoglobin

**2-**Doses between (18-36) GY considered most dangerous for patients because these doses caused anemia , in addition to significant increase mithamoglubin derivative moreover these doses laded to acute decline in efficiency of the bone marrow which observed through decrease in (W.B.C.%) and (PL%) [2].

**3-**The dose (36) GY laded to rising some chemical compounds in irradiated blood and behave as protection line against the effecting of radiation.

**4-**Some patient suffering from acute bleeding especially bladder cancer, breast cancer suffer from pool fluids in the lungs, these fluids are the symptoms of lung bleeding due to decreasing in platlets as a product of the irradiation.

## References

[1]. Frank Settel., Biological effect of nuclear radiation, Kennesaw state uni, (2005).

[2]. Morris Tj. *et.al*.Increasing use of contra lateral prophylactic mastectomy for breast cancer patients, thesis U.S.A., (2007).

[3]. A.Kralli S.H. M oss, British Journal of Dermatology, (2006).

[4]. Z. Szweda- Lewandowska Free, Rad. Res., (2003).

[5]. Belloni. F.*et. al,* Inactivation cross section for mammalian cells exposure to charged particles: Aphenomenological approach, Rad. Prot. Dosimetry, (2002).

[6]. Linda. *Et.al.* , Repairable conditionally damage modelbased on dual poisson processes, (2002a).

[7]. Magorzata karbouwnike and Russel J, Reiter proceeding of the socity for experimental biology and medicine, (2000).

[8]. Normah Yusef, Introduction to ionizing radiation, U.S.A, (1998).

[9]. Mark Juckett. *et.al*., J.Biol. Chem., (1998).

[10]. Devlin and T.M., Biochemistry with clinical Correlations, book U.S.A., (1997

[11]. Christopher Ludlom, Clinical Hematology, New York, (1991).

[12]. Watt, D.E., An approach toward a unified theory of damage to mammalian cells by ionizing radiation for absolute dosimetry, Rad. Prot. Dosimetry, (1989).