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The Effect of Exposure to X-Rays on Some Blood Factors in Human Compared with Control

MeenaSabah Farman[1]*, WissamKhayer Al-Rawi[2], Maryam I. Salman[3]

[1,3]Department of Biology, College of Science, University of Anbar, Anbar, Iraq
[2]Department of physics, College of science, University of Anbar,Anbar, Iraq

Abstract

The effect of the radiation on living cells, tissues, organs, and the whole human body, which results in illness, is commonly correlated with X-Ray. The study's aim is to look at the differences in some blood factors in people who have been exposed to x-rays versus a control group, as well as the impact of exposure time on these blood factors. Samples were collected from patients exposed to radiation, and from people working in the field of radiography. Platelet, HB, ESR, RBC, Monocyte, Eosinophile, Basophile, Neutophile, Lymphocyte, and WBS were investigated as blood factors. The people exposed to radiation were divided into 3 groups according to period of exposure. 10 mL of blood were collected by venipuncture and then transferred to a bottle containing EDTA. RBC, WBC, ESR, and other variables were calculated using the hospital's protocol. The findings indicate that X-rays impact human blood cells; certain blood factors, such as RBC, were found to have no substantial difference between the patient group and the control group ,Although there is a substantial difference in WBS, platelets, and hemoglobin, the longer the time of radiation exposure, the greater the effect on blood factors. There was no substantial difference between the patient and control groups in RBC, but there was a difference in WBS, platelets HB, and there is a direct connection between WBC and ESR, Lymphocytes, and Monocytes, according to this report.

Keywords: X-ray, blood factors, RBC, WBC, Ramadi

Introduction

X-Ray, as described and agreed upon by the majority of scientists and researchers, is a high-energy electromagnetic radiation carried by photons [1] , that is used to produce images in every part of the human body. To do so, various technologies such as radiography, fluoroscopy, CT scan, and mammography were used [2, 3].X-rays are typically associated with health threats because the radiation has the potential to enter living organisms' tissues and affect them by

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producing free radicals[4, 5], It will affect the tissues, organs, and ultimately the whole body, causing disease, by breaking the molecules and causing fragments and ions, which will cause damage to DNA as well as malfunctions in the processes of the cells[6], and depending on the dosage of radiation [7], the patient's sex (female or male), the region of the body exposed, the exposure limit, and the patient's age, the risk of cancer increases; although, in certain situations, radiation is used in cancer therapy called Radiotherapy [8, 9].

Radiation can interfere with cells in a number of ways. For example, radiation can interact with water within living cells, which makes up more than 70% of cell components, creating hydrogen and hydroxide free radicals that can react with other fragments or compounds to create dangerous and toxic products [10, 11]. In terms of direct interaction, radiation interacts with the chromosomes and DNA of cells, influencing cell replication and ultimately leading to death. Human cells, on the other hand, have a remarkable capacity to repair damage caused by X-rays, suggesting that not all forms of human cells are equally susceptible to radiation; certain cells are radiosensitive, while others are radio resistant[9, 12].The truth that X-rays cause biological harm to humans has been known for a long time [13] , and the harmful effects of radiation on health have been observed and recorded since 1902 [14] , with proof reported in the twentieth [15] , and thirty-first centuries, and it was reported as important before World War II [16, 17].In 1996, Ward and his coworker's [18] finds that X-ray affect the blood and considered as a hazardous and cause decreases in the account of blood cells as well as some changes that eventually could be a reason of many diseases. As a result, numerous studies and investigations have been conducted on workers who have been exposed to X-rays and compared them to controls (people who have not been exposed to X-rays), as well as studies on the relationship between the dose of X-ray and its impact on the worker's health, especially on hematology parameters [19, 20] . This study was designed and carried out to determine whether there were any significant changes in hematology parameters in people who had been exposed to x-rays, and to compare the results to a control group.

Materials and Methods

Collecting sample

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Samples were collected from the Ramadi Teaching Hospital in Anbar, as well as from people employed in the radiography department at the hospital and from private clinics. Platelet, HB, ESR, RBC, Monocyte, Eosinophile, Basophile, Neutophile, Lymphocyte, and WBS were all used to determine the presence of various factors in the sample.

Grouping of samples

The patients were divided into groups based on their exposure duration, which ranged from less than 8 years to 9-13 years to more than 14 years. This study included 30 samples that were exposed to radiation over time and 10 control samples.

Protocol

Venipuncture was used to draw 10 milliliters of blood, which was then transferred to an EDTA-containing jar. Haemocytometers were used to count red blood cells (RBCs) and white blood cells (WBCs).Then, blood samples were placed in an anticoagulant tube and counted using an automated platelet count method to determine platelet count.

ESR Erythrocyte sedimentation rate was measured using w. estrogen method. The sedimentation test was carried out according to ICSH 1993[21]. All the other investigation regarding the hematology were carried out according to the protocols mentioned by Taqiand his coworkers [22].

Results and Discussion

The results were shown nosignificant difference in the number of red blood cells when exposed compared to the control group (table 1) ,

These findings are match with findings Moore and Ledford 1985 [(23)]; Suda et al., 1993 [(24)], Taqi et al., 2019 [(22)]. However, a significant decrease in the number of white blood cells (WBC) and platelets wereobserved in people exposed to radiation compared to control, these findings match with the studies made by (Witas et al., 1977 [(25)]; Duguid et al., 1991 [(26)]; Talab et al., 2018 [(20)]). The results showed also a decrease in the rate of sedimentation rate (ESR) of the red blood cells (erythrocyte), concentration of hemoglobin, as well as a decrease in the the number of

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Neutrophile, Monocytes, and Lymphocyte. In another hand, the results were observed no change in the number of Basophile, and Eosinophile.

Table 1: The mean values and standard deviation of the studied factors for (patients and control groups)

Radiation	RBC		WBC		Platelet		ESR		HB	
	Mean	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**
Exposed	4.32	1.322	3.51	1.006	120.63	6.250	8.20	2.858	10.87	0.882
Control	4.72	0.865	6.43	1.164	348.60	75.482	14.80	1.932	14.46	0.955
Radiation	**Neutrophile**		**Basophile**		**Eosinophile**		**Lymphocyte**		**Monocyte**	
	Mean	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**
Exposed	31.50	14.137	1.70	.750	1.70	0.750	14.17	3.030	6.80	1.937
Control	49.50	9.336	1.50	.527	1.50	.527	41.90	13.503	9.80	1.317

Mean difference is significant at P<0.05

Table 2: The averages values and the standard deviation of patients exposed to X-rays with different exposure times

Duration	RBC		WBC		Platelet		ESR		HB	
	Mean	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**
Less than 8 years	4.22	1.05	4.10	.468	120.20	6.34	14.80	3.11	12.18	.48
9-13 years	4.40	1.41	3.41	.270	122.53	7.00	13.93	2.43	10.73	1.00
14 years and above	4.26	1.41	3.35	.331	118.00	4.21	13.80	3.32	10.92	.86
Control	5.72	.86	6.43	.331	348.60	75.48	8.80	1.93	14.46	.95
Duration	**Neutrophile**		**Basophile**		**Eosinophile**		**Lymphocyte**		**Monocyte**	
	Mean	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**
Less than 8 years	134.40	15.11	1.60	.894	3.20	.837	11.80	2.168	6.00	.707
9-13 years	127.80	12.81	1.87	.743	3.80	1.373	14.13	2.973	8.40	2.324
14 years and above	122.1	10.71	1.50	.707	3.20	.789	14.90	3.479	9.30	1.703
Control	49.50	9.33	1.50	.527	3.40	1.174	41.90	13.503	9.80	1.317

Mean difference is significant at P< 0.05

The findings showed that the greater impact on blood factors matched studies conducted by Park and his colleagues [(27),] as well as Zhang's working group [(28)]. In the hands of another researcher, the number of leukocytes decreased as the duration of radiation exposure increased.A substantial decrease in the amount of white blood cells as well as the number of blood platelets was observed in table 2. Only for hemoglobin concentration, an increase in the time of exposure to

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radiation resulted in a significant decrease in concentration, as well as a significant decrease in the rate of ESR. There was no substantial difference in the number of red blood cells (RBC) due to the time span of radiation exposure, nor was there any difference in the number of acidified blood cells (Eosinophils) and basophile blood cells, but there was a significant decrease in the number of blood cells, according to the findings. Lymphocytes, monocytes, and neutrophils are all types of white blood cells. All of the variations were significant at the level of likelihood $P<0.05$. The values of the correlation coefficient between the studied variables in people who have been exposed to x-rays are shown in Table 3.

Table 3: The correlation coefficient values between the studied factors of blodd in patients group (people exposed to x-ray)

	RBC	**WBC**	**Platelet**	**ESR**	**HB**	**Neutrophile**	**lymphocyte**	**Eosinophile**	**basophile**	**Monocyte**
RBC	1	0.073	0.271	0.043	0.031*	0.002	0.024	0.267	0.027	0.082
WBC	0.073	1	0.036	0.013*	0.113	0.070	0.035*	0.078	0.178	0.031*
Platelet	0.271	0.036	1	0.174	0.075	0.299	0.083	0.080	0.215	0-.120
ESR	0.043	0.013*	0.174	1	0.123	0.266	0.013	0.011	0.000	0.043
HB	0.031*	0.113	0.075	0.123	1	0.088	0.296	0.311	0.241	0.017
Neutrophile	0.002	0.070	0.299	0.266	0.088	1	.125	0.027	0.036	0.063
lymphocyte	0.024	0.035*	0.083	0.013	0.296	.125	1	0.061	0.008	0.123
Eosinophile	0.267	0.078	0.080	0.011	0.311	0.027	0.061	1	0.325	0.329
basophile	0.027	0.178	0.215	0.000	0.241	0.036	0.008	0.325	1	0.159
Monocyte	0.082	0.031*	0.120	0.082	0.017	0.063	.123	0.329	.159	1
	$x10^3/\mu L$	$x10^3/\mu L$	$x10^3/\mu L$	%	mg/dl	$x10^3/\mu L$	$x10^3/\mu L$	$x10^3/\mu L$	$x10^3/\mu L$	$x10^3/\mu L$

**P<0.05*

The findings revealed that the number of white blood cells (WBC) and the rate of erythrocyte sedimentation rate are related (ESR).The number of red blood cells and the concentration of hemoglobin HB were also found to be related. The findings also revealed a link between the number of lymphocytes and total white blood cells (WBC), as well as a link between the number of monocytes and total WBCfor those who have never been exposed to x-rays, the mean values and standard deviations of the variables evaluated table 4.

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Table 4: Descriptive statistics

Parameter	Mean	Std. Deviation	No.
RBC	4.32	± 1.322	30
WBC	3.51	± 1.006	30
Platlat	120.63	± 6.250	30
ESR	14.20	± 2.858	30
HB	10.87	± **0**.882	30
N	131.50	± 14.137	30
B	1.70	± **0**.750	30
E	3.50	± 1.137	30
Lympho	14.17	± 3.030	30
Mono	8.80	± 1.937	30

The effect of radiation on the bone marrow, which is significantly influenced by the rays and is considered the key generator of the different types of cells in the body, was the cause of these changes in relation to the studied causes. The results obtained from the research are consistent with the findings of the WHO study for radiation protection, as 90% of the total radiation doses received by people from different countries of the world are due to their exposure to X-rays, as the bone marrow cells divide rapidly, they are very sensitive to radiation and thus appear on the various types of cells that the bone marrow generates. [17, 29].

Conclusions

X-ray affect human cells, tissues, organs, and may cause fatal depending on time of exposure, the dose of the radiation and other factors.Blood cells affected with radiation, and some blood factors was found with no significant difference between patient group and control group in RBC, while there is a significant difference in WBS, platelets HB, There is a direct correlation between WBC from a side and ESR, Lymphocyte, and Monocytes.The greater the period of exposure to radiation, the greater the effect on the blood factors except RBC, Eosinophils, Basophiles which does not affected with exposure time.

Conflict of interest

The authors have stated no conflicts of interest.

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Authors' Declaration

The writers declare that the work discussed in this article is their own original work, and that any arguments based on its content will be held against them.

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