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# WBC, PLT of Women's Blood Affects by Alpha Deposition into the Body

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**Abstract:** This study is presented the effects of alpha deposition into the women blood samples, most of WBC, RBC and PLT counted by used automatic CBC machine before and after irradiation with radium source. The values showed statistical significance for WBC and PLT based on the mean of their differences before and after irradiation which decreased with increasing radiation. Significant differences were found in the platelet and WBC before and after treatment with radiation after 10 minutes of activities of $^{226}$Ra. Although, significant decrease in platelet and WBC was observed after 15 minutes of treatment with $^{226}$Ra. However, no significant ($p > 0.05$) change in red blood count RBC was found after 15 minutes irradiated by radium, therefore, WBC/PLT were high significant decrease ($p = 0.001$) after irradiation.

**Keywords:** Radiation, Blood, WBC, RBC, PLT, Alpha Deposit

## 1. Introduction

Radiation plays a significant role in life generally, and in the fields of life sciences and medicine. Radiation can result in several different types of biological effect, depending mainly on the part of the body irradiated [1]. The first case of radiation induced leukemia was reported in 1911. This has been demonstrated by studies on the survivors of atomic bomb explosions in Japan [2]. Radioactive radon gas is generally regarded as a health hazard, naturally because of its ability to produce several different types of biological effects [3]. Alpha particles react directly with DNA to generate double-strand breaks or interact with water to produce hydroxyl radicals, both of which affect biological materials negatively [4].

An active cell is affected negatively by the direct interaction with radiation source leading to the death or mutation of the cell. These outcomes are as a result of the cell's relative sensitivity to radiation. One-third of the assimilated decay products from radon are transported from the lungs into the bloodstream through the stomach or intestinal walls and distributed throughout the body [5]. The lymphocyte is a distinct kind of mature white blood cell that is very radiosensitive for unknown reasons. Lymphocytes are more susceptible to the effects ionizing radiation compared other mature blood cells. White blood cell population reduces a few days after exposure, often accompanied by slow decrease in red blood cells. Red cells have longer life spans than white blood cells, so they are substituted more gradually [6]. The harmful effect of radon was elaborated as an increase in chromosome damage [7]. Aberrations in lymphocytes serve as a sensitive indicator of accidental exposures to doses greater than about 0.1 Gy [8].

## 2. Methodology

For this study, blood samples were collected from 11 women from Malaysia region with fertility problems. The purpose is to examine the effects of alpha particles on the fertility of women by the analysis of major blood components White blood cell (WBC), Red blood cell (RBC), and Platelet (PLT). The blood samples were collected in the clinic (Health Center) of Universiti Sains Malaysia (USM) from patients aged between 19 and 41 years at two different

times and during two different processes. Anexceptional blood tube contain Ethylene Di-amine Tetra Acid (EDTA) was used. Each sample was collected from the women by used a syringe, and then transferred into a tube. The volume of the samples before division was 4ml. Then, each sample of blood was divided regularly into two (2) parts. The study used in vitro irradiation of alpha particles along with hematology Count Blood Cell (CBC) machine to examine the blood parameters (WBC, RBC, and PLT) of women blood before and after irradiation to investigate the impact of the radiation on women with fertility problems. The blood samples were irradiated at a room temperature of 24°C at the University Sciens Malaysia (USM), School of physics.

Irradiation was carried out at room temperature 24°C using $^{226}$Ra. The irradiation was repeated for 2 different time exposures (10 minutes, 15 minutes) of surface samples to the $^{226}$Ra, therefore the samples were divided into two parts and placed in the Polymerizing Vinyl Chloride (PVC) tubes (height: 12.0 cm, diameter: 3.0 cm). The distance between the source and blood surface is fixed at 10.5cm inside the PVC tube with 5 μCiactivity for source $^{226}$Ra.

# 3. Statistical Analysis

All statistical calculations were performed using Statistical Package for the Social Sciences (SPSS) for Windows, Standard version 20.0. The blood data were analyzed for irradiation. Paired samples t test and one way ANOVAs were used toinvestigate the normality distribution of the data. In addition, Wilcoxon Signed Rank test and Kruskal Wallis test (non-parametric tests) were used in case of non normal distribution

# 4. Results and Discussion

The effects of radiation (alpha deposition) on the blood the women with fertility problems were determined by conducting haematology blood tests before and after irradiation by exposure to the radium source for alpha. The data were analyzed by used the statistical SPSS analysis to check and examine the presence of any relation between the effect of alpha particles on the blood samples and the 3 major blood parameters (WBC, RBC, and PLT) of the blood sample.

## *4.1. Participants Demographic and Laboratory Characteristics*

***Table 1.*** *Participants' demographic and laboratory characteristics.*

| Variables (33 participants) | % (no.) / Mean (± SD) | Median |
|---|---|---|
| Age (years) | 29.00 ± 6.356 | 27.00 |
| Total WBC control | 8.270 ± 3.045 | 7.500 |
| Total WBC radiation | 7.159 ± 2.709 | 6.500 |
| Total RBC control | 5.588 ± 1.918 | 5.06 |
| Total RBC radiation | 5.050 ± 0.990 | 4.95 |
| Total PLT control | 162.576 ± 64.577 | 162.00 |
| Total PLT radiation | 145.121 ± 51.814 | 143.00 |

There were eleven participants who agreed to be involved in current study, with mean age 29.00 ± 6.356. The participants demographicand laboratory characteristics were found in the Table 1.

## *4.2. Difference of Overall Blood Cells Before and After Radiation*

Paired t test was used to finding the difference for the parametric variables; it used to determining the difference of WBC between control and irradiation. And Wilcoxon Signed Rank test was used to finding the difference of the non-parametric variables; also it used to find the difference of RBC and PLT before and after irradiation. Significant differences found in all blood cells, where these cells were reduced after radiation, as shown in the Table 2.

***Table 2.*** *Difference of blood cells between control and after irradiation.*

| Laboratory measurements | | Mean (± SD) | Mean difference ± SD | | | *p* value |
|---|---|---|---|---|---|---|
| WBC | Control | 6.241 ± 2.149 | 0.198 ± 0.408 | | | 0.009* |
| | Irradiation | 6.043 ± 2.055 | | | | |
| Laboratory measurements | | Ranks | Number | Mean rank | Z value | p value |
| RBC | Irradiation - control | Negative ranks | 22 | 17.23 | 0.070 | 0.133** |
| | | Positive ranks | 10 | 17.16 | | |
| | | Ties | 1 | | | |
| PLT | Irradiation – control | Negative ranks | 25 | 14.16 | -3.193 | <0.001** |
| | | Positive ranks | 6 | 17.25 | | |
| | | Ties | 2 | | | |

* Paired t test
** Wilcoxon Signed Rank test

The WBC decreased after irradiation because clearly, the maximum level of alpha radiation based on field strength of $^{226}$Ra. WBC demonstrated high statistical significance (p = 0.009), because the mean of White Cell Count for the exposed to alpha radiation were observed to be decreased, respectively when compared to the mean White Cell Count for control**.**

The number of RBC showed no significant change after irradiation. The mean count of RBC parameter was not statistically significant (p = 0.133) as the count remained after 10 minutes of irradiation and after 15 minutes of irradiation, which is similar to the mean Red Cell Count of control, as shown in the Table 2. The results are consistent with the studies of [9, 10]. The number of PLT count has decreased after irradiation. The mean count of PLT parameter was highly significant statistically (p =0.001) after 10mintues

of irradiation and after 15 minutes irradiationbecause the mean of PLT count for the exposed to alpha radiation were observed to be decreased.

### *4.3. Differences in Blood Cells Before and After Irradiation with Time*

Wilcoxon Signed Rank test used to find the differences of non-parametric results for blood cells before and after irradiation. No significant differences observed for blood cells before and after radiation with 10 minutes time. All blood cells got significantly lower levels after 15 minutes of radiation only WBC was significant differences in this time, as shown in the Table 3.

***Table 3.*** *Difference of blood cells before and after radiation with time.*

| Variable | Difference | Ranks | Number | Mean rank | *p* value |
|---|---|---|---|---|---|
| WBC 10 mins | Radiation – control | Negative ranks | 5 | 6.90 | 0.475* |
| | | Positive ranks | 5 | 4.10 | |
| | | Ties | 1 | | |
| RBC 10 mins | Radiation – control | Negative ranks | 7 | 7.21 | 0.120* |
| | | Positive ranks | 4 | 3.88 | |
| | | Ties | 0 | | |
| Variable | Difference | Mean (± SD) | Mean difference | | *p* value |
| PLT 10 mins | Control – radiation | 127.455 ± 62.237<br>136.909 ± 57.342 | - 9.454 | | 0.635** |
| WBC 15mins | Control – radiation | 10.509 ± 2.997<br>8.400 ± 2.839 | 2.109 | | 0.009** |
| RBC 15 mins | Control – radiation | 6.206 ± 1.884<br>5.289 ± 1.217 | 0.916 | | 0.023** |
| PLT 15 mins | Control – radiation | 176.000 ± 60.548<br>131.909± 39.058 | 44.09 | | 0.026** |

* Wilcoxon Signed Rank test
** Paired t test

### *4.4. Differences Among Blood Cells With Time*

Non parametric test Kruskal Wallis used to find the differences of WBC and RBC, while One Way ANOVA used to find the differences in PLT with time differences. The overall blood cells of participants were not statistically different with time $p > 0.05$, as shown in the Table 4.

***Table 4.*** *Differences among blood cells with time.*

| Variable | | Number | Mean rank | Chi-square | *p* value |
|---|---|---|---|---|---|
| Total WBC after radiation | 10 mins | 11 | 14.05 | 2.381 | 0.304* |
| | 15 mins | 11 | 20.36 | | |
| Total RBC after radiation | 10 mins | 11 | 15.77 | 0.330 | 0.848* |
| | 15 mins | 11 | 18.14 | | |
| Variable | | Number | Mean (± SD) | F | *p* value |
| Total PLT after radiation | 10 mins | 11 | 136.909 ± 57.341 | 1.479 | 0.244** |
| | 15 mins | 11 | 131.909 ± 39.831 | | |

* Kruskal Wallis test
** One Way ANOVA

WBC and PLT decreases after irradiation while RBC showed no considerable changes, which is in agreement with the result of [11]. No significant decrease in red blood count was found after irradiation by radium that is concert with [12]. However, the WBC reduced and susceptibility to infection increases, because of insufficient white blood cells to fight bacteria, viruses, and other microbes that damage DNA [4] resulting in cell dysfunction (somatic effect) or mutations (genetic damage) [13]. Therefore, radiation affects the ability of women to pregnant [13, 14]. Thus, the irradiation of blood with sufficient ionizing radiation may be decrease women fertility because neither red cells nor platelets contain the genetic material for replication. Also decreased PLT after irradiation inhibits blood clotting.

## 5. Conclusion

WBC and PLT decreased after irradiation, while RBC increased a little after irradiation. No significant decrease in red blood count was found after irradiation by radium. Thus, the irradiation of blood with sufficient ionizing radiation may be decrease women fertility.

## Abbreviations

WBC: White blood cell, RBC; Red blood cell, PLT: Platelet, EDTA: Ethylene Di-amine Tetra Acid, CBC: Count Blood Cell, USM: University Sciens Malaysia, PVC: Polymerizing Vinyl Chloride, SPSS: Statistical Package for the Social Sciences.

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