The Effects of Alpha Emitters on Powder Blood for Women's Infertility in Kurdistan –Iraq

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Abstract- Blood samples were acquired from 60 women aged 20 to 44 years having decreased fertility, infertile or with uterine tumors in the Iraqi Kurdistan region. A pilot experiment was performed to determine alpha radionuclides in powder blood. The concentrations of alpha emitters in powdered blood ranged from 0.0036ppm in Eiskan to 0.0096 ppm in Halabjay–Kon in Sulaymania Governorate, with average (0.0085 ppm) that was high significant difference in concentration($p<0.001$). And the alpha emitter concentrations in powdered blood ranged from 0.0031 ppm in Shorsh to 0.0146 ppm in Sedakan in the Erbil Governorate, with average (0.0062 ppm) that was high significant difference in concentration($p<0.001$). The average results of concentration in Erbil was higher than the concentration in Sulaymania. Exposure to ionizing radiation higher than the environmental radiation levels causes different diseases. To prevent dysfunction and decreases in the life span of red blood cells, the concentrations must be determined because the high concentration and degree of exposure to alpha particles are more damaging to the living tissue and gonads, most of data have been significant, therefore, the result shown that the radiation effect on women fertility.

Index Terms- Women fertility, powder blood, alpha emitters, ionizing radiation and Kurdistan region

I. INTRODUCTION

The Uranium enters the bodies through the food, water and air. When you breathe uranium dust. The size of the uranium dust particles and how easily they dissolve determines where in the body the uranium goes and how it leaves y our body, they may gradually dissolve and go into blood. If the particles do dissolve easily, they go into the blood more quickly (Fernando et al., 2011). The soluble particles will be absorbed in the blood and remove from it to other organs (Tanabo et al., 2001)

Blood is one of the most widely used and accepted matrices for environmental toxicology (Fernando et al., 2011). The alpha emitting radioactive substances are harmful to normal human tissues because of their high attenuation power. Alpha particles cause damage to various organs through their chemical and radioactivity toxicity effects (Kendall et al., 2002).

Alpha particles are more damaging to living tissues because they are more massive and more highly charged than other types of ionizing radiation (Baker et al., 1992, Meo 2004) White blood cells and other hematopoietic cells are constantly regenerating; therefore, the hematopoietic organs are few of the most sensitive organs to radiation. The effective degree of ionization caused by incident alpha particles depends on their energy and length of exposure, and causes excitation of molecules in the blood. Ionization and excitation occur because of absorption by biological materials. The extent of absorption is strongly depend on radionuclide dermal absorption. The damage to living cells affects the gonads, which may lead to infertility in women (Meo et al., 2004).

New and elaborate techniques for low-level alpha particle detection have been developed over the past years. These techniques have wide potential applications in the study of radioactivity in biological systems, but their crucial role depends on their ability to monitor alpha emissions in human tissues, particularly in women. In this paper, we report a pilot experiment to determine the feasibility of monitoring radioactivity in the bloodstream by immersion of CR-39. Concentrated and powdered blood samples were used to detect the background levels of ^{222}Rn and daughter nuclei from ^{222}Rn decay and alpha emitters. Tracks of ionizing particles were detected using CR-39 detectors. In the present work, this technique was utilized to the study blood (Nsiahet al., 2011). When charged particles pass through CR-39 detectors, they break the molecular bonds of CR-39 to form nuclear damage trails with high ionization (Libinaki et al., 2006).

The samples were collected from women who have symptoms of infertility from different locations in the Iraqi Kurdistan region who were prepared suitably for practical work under the supervision of the medical authority and institutions. Then, the physical study was conducted to investigation

II. MATERIALS AND RESEARCH METHODOLOGY

Blood

The function of the blood is to deliver nutrients, hormones and oxygen to tissues (Kendall) The blood consists of cells surrounded by a liquid matrix, which circulates through the heart and blood vessels. Total blood volume in females is (4-5) litters, cells and cells fragments it is about (55%) (Tanabo et al., 2001). Blood is a circulating tissue composed of fluid plasma and cells (red blood cells, white blood cells, platelets). Anatomically, blood is considered as connective tissue because of its origin in the bones and its function. Radiation and chemotherapy adversely affect blood cell counts (Puchala et al., 2004).

Sample collection and preparation

Collection of fresh blood

Blood samples were collected from 90 women, who have decreased fertility, infertile and who suffer the tumor in uterus of women in the Iraqi Kurdistan region. The age women ranged from 21 years to 43 years. Three 3 mL blood samples were aseptically collected from each subject using disposable syringe. Each sample blood was immediately transferred into a tube containing ethylenediamine tetraacetic acid (EDTA) in order to prevent blood clotting. The personal information of each woman was recorded and labeled. The samples were stored at 4 °C (Zhu) because the blood should be stored at 2–4 °C (Zhu et al., 2009, Roussetski et al., 2004).

Preparation of powder blood

Blood samples were heated at 70 °C for six hours to dry and oxidize organic material. The samples were then ground and pulverized several times, and sieved through a fine mesh (0.5 mm) to obtain a powder with a homogenous grain size distribution. The alpha concentrations were measured using the long tube technique with the plastic detector (CR-39) to record the tracks of α-particles from radon during exposure. Then, 0.5 g from each powder blood samples were placed in PVC tubes with one CR-39 detector placed on the samples inside the tube, shown in figure 1

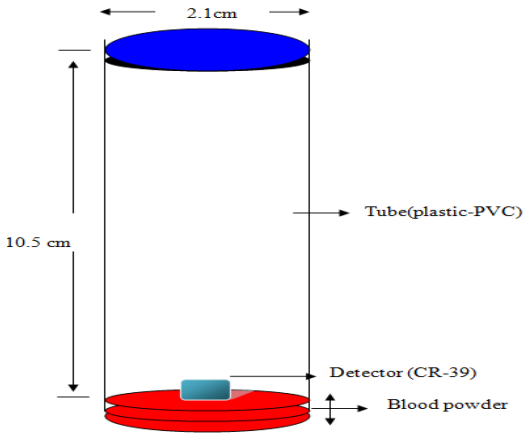

Figure 1. A long-tube PVC designed to record alpha emitters in laboratory.

The tubes were stored for about 60 days and left in the same medical refrigerator. After a period of 60 days, all detectors (CR-39) were etched chemically at the same laboratory in 6.25N of NaOH solution at temperature of 60 ^{o}C for 8 hours, and the tracks density were recorded using the optical microscope. The density of the tracks (ρ) in the samples was calculated according to the following relation (Meo 2004).

Track density (ρ) = Average number of total pits (tracks) /Area of field view…….1

The concentrations of alpha emitters in the blood samples were measured by comparison between track densities registered on the detectors and that of the standard blood sample from the relation (Karim et al., 2010).by the following relation:

$$C_X \text{ (sample)} / \rho_X \text{ (sample)} = C_S \text{ (standard)} / \rho_S \text{ (standard)} \quad \text{……...2}$$

$$C_X = C_S \,.\, (\rho_X / \rho_S) \quad \text{……..…... 3}$$

where :

C_X : Uranium concentration of blood in unknown sample (ppm).

C_S : Uranium concentration of blood in standard sample (ppm).

ρ_X: Track density of unknown sample (tracks/mm^2).

ρ_S: Track density of standard sample (tracks/mm^2)

III. Statistical Analysis

All statistical calculations were performed using SPSS for Windows, Standard version 20.0. by used Independent t test and Paired t test.

IV. Result and Discussion

An in vitro study was conducted to determine the track density of alpha emitters in powdered blood from women. Each detector was scanned using an optical microscope. The alpha emitters concentration in the powdered blood samples were calculated using the formula (3) using a uranium standard. The results of the experiment confirmed the feasibility for determining the activity of individual radionuclide's in the samples by put the CR-39 NTDs on the powdered blood. The detection of surplus activity in the blood of women indicates that alpha emitters are detectable in the blood.

To prevent dysfunction and decreases in the life span of red blood cells, the concentrations must be determined because the high concentration and degree of exposure to alpha particles Alpha particles enter cells, it can cause an excitation of molecules in the blood, Whenever alpha particles, which are emitted from radon decay products, pass through a cell, DNA will likely be damaged (ionized) because the penetrating alpha particles causes genomic changes, that are more damaging to the living tissues because they are more massive and more highly charged than other types of ionizing radiation, which results in somatic effects or genetic damage to cell (Meo, 2006). Most important of which are the chromosomal changes that ultimately lead to conversion of normal cells into non normal cell , therefore, the damaged cells affect the gonads, which may decrease fertility in women (Nsioh et al. 201). These changes depend on the energy of alpha particles inside the blood, as well as the energy loss and concentration of alpha particles in the blood.

The concentration of alpha emitters in blood powder samples of women with problem's infertility in Sulaymania showed in the Table 1

The maximum concentration of alpha emitters in blood of women was found (0.0096 ppm) (43 years old) in Halabjay kon / Sulaymania governorate, and minimum concentration of alpha emitters in blood of women was found (0. 0036ppm) (22 years old) in Eiskan/ Sulaymania governorate, with average (0.0062 ppm).

Table 1: Evaluation of concentration of alpha emitters in powder blood for women in Sulaymania governorate in Iraqi Kurdistan region.

N.S.	Location	Age/ Years	Track density of alpha emitters track /mm^2	Concentration of alpha emitters (ppm)
1	Eiskan	22	8.061	0.0036
2	Khurmal	26	8.469	0.0038
3	Chamchamal	27	9.581	0.0043
4	Shekhan	28	9.924	0.0044
5	Darbandikhan	28	9.996	0.0045
6	Rzgary	29	10.317	0.0046
7	Bakhteary	30	10.317	0.0046
8	Reaea	31	11.044	0.0049
9	Takea	33	11.393	0.0051
10	Kalar	33	11.480	0.0051
11	Khalakan	34	11.743	0.0052
12	Bazean	34	11.931	0.0053
13	Kfry	35	12.193	0.0054
14	Sharawany	36	12.993	0.0058
15	Zaraeen	36	14.352	0.0064
16	Toymalek	36	14.917	0.0067
17	Said sadiq	36	14.958	0.0067
18	Penjween	36	15.277	0.0068
19	khormal	37	15.729	0.0070
20	Zargata	39	15.913	0.0071
21	Bardarash	38	16.208	0.0072
22	Mawat	39	16.282	0.0073
23	Dukan	39	16.849	0.0075
24	Qaladza	39	17.314	0.0077
25	Halabjay taza	40	17.547	0.0079
26	Rania	40	18.196	0.0081
27	Mamostayan	41	19.133	0.0086
28	Sulaymania	41	19.496	0.0087
29	Arbat	42	20.049	0.0090
30	Halabjay kon	43	21.387	0.0096
**			14.413	0.0062

**=Mean

The concentration of alpha emitters in blood samples of women with problem's fertility in Erbil showed in the Table 2 The maximum concentration of alpha emitters in blood of women was found (0.0146 ppm) (42 years) in Sedakan / Erbil governorate, and minimum concentration of alpha emitters in blood of women was found (0. 0031 ppm) (21 years) in Shorsh / Erbil governorate, with average (0.0085 ppm).

Table 2: Evaluation of alpha emitters concentration powder blood for women in Erbil governorate in Iraqi Kurdistan region, by passive method

N.S.	Location	Age/ Years	Track density of alpha emitters track /mm^2	Concentration of alpha emitters (ppm)
31	Shorsh	21	6.958	0.0031
32	Kas-Nazan	22	7.019	0.0031
33	Shaqlawa	25	7.077	0.0032
34	Salahadden	26	13.010	0.0058

35	Nazanen	26	13.436	0.0060
36	Holy- Zatd	27	13.473	0.0060
37	Kareat- Zanko	27	15.336	0.0069
38	Nawato dw	27	15.432	0.0069
39	Erbil Center	28	16.053	0.0072
40	Khalefan	28	16.073	0.0072
41	Rzgary	29	16.516	0.0074
42	Aeen-Kawa	29	16.868	0.0075
43	Saed -Taqan	29	17.430	0.0078
44	Sarsang	30	18.496	0.0083
45	Qshtapa	31	18.610	0.0083
46	Makhmur	31	19.212	0.0086
47	Shaqlawa	32	19.639	0.0088
48	Haji-Omaran	33	19.948	0.0089
49	Rawanduz	34	20.550	0.0092
50	Barzan	34	20.686	0.0093
51	Harer	35	21.131	0.0095
52	Taq-Taq	36	22.875	0.0103
53	Shekholla	37	23.108	0.0104
54	Prdea	38	24.427	0.0109
55	Ronaki	38	25.182	0.0113
56	Koya	38	25.920	0.0116
57	Barsren	40	26.132	0.0117
58	Deana	41	26.965	0.0121
59	Eiskan	42	27.625	0.0124
60	Sedakan	42	32.509	0.0146
**			18.923	0.0085

**=Mean

Alpha particles are more damaging to the living tissue and exposure of the gonads leads to decreased fertility in women

3. Differences in participants' laboratory outcomes between Erbil and Sulaymania

Significant differences found in participants' laboratory results between Erbil and Sulaymania. Track density of powder blood of Erbil's participants had significantly higher means than participants of Sulaymania. And powder blood concentration of alpha emitter, the means was found lower in results of Sulaymania' participants than results of Erbil' participants, the result of the alpha emitter concentrations of the blood powdered of women's problem fertility in Sulaymania was high significant difference ($p<0.001$), also the result of the alpha emitter concentrations of the blood powdered of women's problem fertility in Erbil was high significant difference ($p<0.001$), as shown in Table 3

Table3: Differences of participants' laboratory outcomes between Erbil and Sulaymania

Variables		Mean ± SD	Mean difference	*p* value
Track density in powder blood	Sulaymania	14.102 ±3.703	-4.822	**0.001**
	Erbil	18.923 ±6.200		
Conc. of alpha emitters in powder blood	Sulaymania	0.0062 ±0.029	-0.0077	**0.001**
	Erbil	0.0085 ± 0.048		

Independent t test

2- Correlations between participants' age and their laboratory results

Pearson correlation used to find out the correlations among the parametric results. Significant strong positive correlation found for age to track density of powder blood, powder blood concentration of alpha emitter. Significant positive correlation also found for track density of powder blood, powder blood concentration of alpha emitter, as shown in Table 4.

Table 4: Correlations between participants' age and their laboratory ou

		Age	Track density of alpha emitters	Co. of alpha emitters in powder
Age	Pearson Correlation	1	**0.723**	**0.944**
	p value		**<0.001**	**<0.001**
Track density of powder blood	Pearson Correlation	**0.723**	1	**0.612**
	p value	**<0.001**		**<0.001**
Concentration of alpha emitters in powder blood	Pearson Correlation	**0.944**	**0.612**	1
	p value	**<0.001**	**<0.001**	

Correlation is significant at the 0.01 level (2-tailed)

V. Conclusion

The finding from this research shows that alpha concentration level in powdered blood in two places were different, the concentration of alpha emitters in blood of women with weakness in fertility in Iraqi Kurdistan region is higher in Erbil more than the concentration of alpha emitters of blood in Sulaymania. The alpha particles are more damaging to the living tissue, because they are more massive and more highly charged than other types of ionizing radiation, resulting in cell somatic effect or genetic damage, and destroy the living cells causing impact in gonads, leading weakness in women fertility. Most of data have been significant, therefore, the result shown that the radiation effect on women's fertility

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References

[1] BAKER N., et al., Exposure to ionising-radiation from x-rays in the intensive therapy unit-St Vincent's Hospital. Australian Critical Care, vol. 5, p. 24. 1992.

[2] FERNANDO G., et al., Biomonitorization of cadmium, chromium, manganese, nickel and lead in whole blood, urine, auxiliary hair and saliva in an occupationally exposed population Science of the Total Environment. 2011 Elsevier

[3] Karim M. S. Mohammed A.H. & Abbas A.A., Measurement of Uranium Concentrations in Human blood in some the Regions of Baghdad Governorate Ibn Al- Haitham AITHAM J. Fo R Pury & Appil Sci. Vol .23 (2). 2010.

[4] Kendall G. M., & Smith T. J. Doses to organs and tissues from radon and its decay products. J. Radiol. Prot. 22, 389–406. 2002.

[5] Libinaki R., et al. Evaluation of the safety of mixed tocopheryl phosphates (MTP) -A formulation of a-tocopheryl phosphate plus a-di-tocopheryl phosphate. Food and Chemical Toxicology 44, 916–932, Australia. Elsevier. 2006.

[6] MEO S. A., et al., Hematological findings in male x-ray technicians. Saudi medical journal, vol. 25, pp. 852-856. 2004.

[7] MEO A., Hazards of x-ray radiation on the quantitative and phagocytic functions of ploymorphonuc lear neutrophils in x-ray technicians. occupy health, vol. 48, p. 5. 2006.

[8] Nsiah-Akoto I., Fletcher J. J., Oppon O. C., & Andam A.B. Indoor Radon Levels and the Associated Effective Dose Rate Determination at Dome in the Greater Accra Region of Ghana Research Journal of Environmental and Earth Sciences 3(2): 124-130, 2011. Accra, Ghana. 2011.

[9] Puchala M., et al., The Influence of Radiation Quality on Radiation-induced Hemolysis and Hemoglobin Oxidation of Human Erythrocytes. Journal of radiation research, vol. 45, pp. 275-279. 2004

[10] Tanabe K., ET AL., Prediction of the potentially fertile period by urinary hormone measurements using a new home –use monitor: comparison with laboratory hormone analyses. Human Reproduction. Vol. 16, No.8 pp.1619-1624. 2001.

[11] ZHU D., et al., Fabrication and characterization of Li3TaO4 ceramic pebbles by wet process," Journal of Nuclear Materials, vol. 396, pp. 245-250. 2009.

[12] [ROUSSETSKI A. S., CR-39 Track detectors in cold fusion experiments: Review and perspectives. P. N. Lebedev Physical Institute, Russian Academy of Sciences. 2004.

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