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Assessment Of Uranium Concentrations In Blood Samples For Women With Breast Cancer In Babil Governorate- Iraq

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ABSTRACT

The object of this project is to determine the concentrations of "uranium" concentration in human blood in 60 selected breast cancer patients (i.e., 30 with cancer and 30 healthy) Babylon Governorate, Iraq. in different ages. By using CR-39, the results indication that the maximum "uranium" concentration in b1ood (2.235ppm) and the minimum concentration (1.034ppm) with the mean uranium concentration in b1ood of patients was (1.7901ppm), while healthy where the maximum value (1.163ppm) The minimum value (0.258ppm) with the mean value (0.7764ppm.). Finally, the uranium concentrations in all samples were below the allowed limit of ICRP and values of other studies.

1. Introduction

Mainly, Radiation is the process emission for energy form of waves or particles across through a material medium into space, where its emitted from two primary sources that may a person expose to These are artificial and natural sources. artificial, which is generated by bombarding stable isotope nuclei with other forms of nuclear particles [17]. Natural radiation consists of three primary types based on their source, namely celestial, terrestrial and inner. The cosmic nuclides are produced by cosmic rays from the spallation of atoms in the atmosphere. The cosmic rays are the primary radiation from outer space which continually bombard stable atoms in the atmosphere and produce radionuclides. The terrestrial nuclides are series as Uranium, Actinium, and Thorium, while, non-series such as potassium [7], [11]. Artificial radiations used into medical applications, nuclear reactors, production of energy, nuclear weapons, and prospecting, lead to increase the radiation dose of absorbed by humans, thus the radiation concentration in the blood increase [16], [15]. Radionuclides are found in all environmental elements. They are present in varying amounts in water, air, soil, vegetables, animal, and even the human body itself [3]. The main methods of introducing radionuclides into the human body are ingestion and inhalation. Ingestion is the entry of radionuclides through drinking water and eating food. Whereas the inhalation of radionuclides by inhaling air or dust particles containing radioactive materials [5].

2. Materials And Method

2.1 Sample Collection

The samples were selected from the cancer hospital from different areas such as Al-Qasim, Al-Madhatiya, Al-Shumali, Jableh, Abi- Gharq, Sinjar, Nader, Qaryat Al- Dulab, and others, in Babylon Governorate, Iraq. The study was conducted on 60 selected breast cancer patients (i.e., 30 with cancer and 30 healthy), whose age ranged between 20 and 70 years old, as the case group Patient information obtained using a questionnaire comprising name, age, region and other data. It should be noted that all the patients had breast of cancer and had not received radiotherapy. Table 1: shows the basic information for the Patient and healthy group in the current study.

Table 1: Basic information for the healthy and Patient group in the current study.

Code	Age	Gender	Location	Code	Age	Gender	Location
H_1	22	Female	Al-Madhtiyah	C_1	29	Female	Qaryat Al Dulab
H_2	27	Female	Al-Imam	C_2	32	Female	Nadir
H_3	29	Female	*Bab Al-Mashhad*	C_3	35	Female	Al-Mahmudiyah
H_4	30	Female	Sinjar	C_4	37	Female	*Al- Askari*
H_5	30	Female	Al-Shomali	C_5	38	Female	*Abu –Khastawi*
H_6	30	Female	Al-Qasim	C_6	40	Female	Al- *Jazaer*
H_7	30	Female	Nadir	C_7	42	Female	Jableh
H_8	31	Female	Al Talee'a	C_8	43	Female	Shuber
H_9	33	Female	Saddat AlHindiyah	C_9	44	Female	Al-Muharibeen
H_{10}	38	Female	Al-Thawra	C_{10}	45	Female	Jableh
H_{11}	40	Female	Al-Shomali	C_{11}	46	Female	Al- *Jazaer*
H_{12}	40	Female	Al- Kifl	C_{12}	46	Female	Nadir
H_{13}	41	Female	Jableh	C_{13}	48	Female	*Al-Asatha*
H_{14}	41	Female	Sinjar	C_{14}	48	Female	Nadir
H_{15}	44	Female	Nadir	C_{15}	50	Female	Al- Muhaweel
H_{16}	46	Female	Al Talee'a	C_{16}	51	Female	*Al- Musayyib*
H_{17}	46	Female	*Al- Askari*	C_{17}	55	Female	Al-Bakrli
H_{18}	47	Female	Al- Muhaweel	C_{18}	55	Female	Al-madhtiyah
H_{19}	50	Female	Abi- Gharaq	C_{19}	59	Female	Al- Muhaweel
H_{20}	50	Female	Imam	C_{20}	59	Female	Qaryat Al Dulab
H_{21}	50	Female	Abi- Gharaq	C_{21}	60	Female	*Al-Thila*
H_{22}	51	Female	Al -Madhtiyah	C_{22}	60	Female	*Al Abbasiya*
H_{23}	55	Female	Al- Nile	C_{23}	61	Female	Al-madhtiyah
H_{24}	56	Female	Qaryat Al Dulab	C_{24}	61	Female	Al-Hamza
H_{25}	57	Female	Abi- Gharaq	C_{25}	62	Female	Al- Muhaweel
H_{26}	60	Female	Al-Musayyib	C_{26}	65	Female	Krayta'a
H_{27}	60	Female	Al-Nile	C_{27}	68	Female	Al- Musayyib
H_{28}	64	Female	Al- Madhtiyah	C_{28}	70	Female	Al- Musayyib
H_{29}	65	Female	Abi- Gharaq	C_{29}	70	Female	Al- Hashmiya
H_{30}	70	Female	Al-Imam	C_{30}	70	Female	Qaryat Al Dulab

2.2 Experimental Method

In this technique, half ml volume of blood serum was placed in an emanation chamber (Arth Al-Rafidain, china), which was then closed for a period of four months in order to reach equilibrium between radium and

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radon.CR 39 type detector (made by the Track Analysis Systems Ltd., Bristol, UK) with a thickness of 500 µm was placed in blood samples for measuring alpha particles. Specifically, one-track detector was placed in a container. These detectors were fixed at the top end of a plastic tube whose diameter was 1.5 cm and its length was 6 cm. CR 39 type detector was cut into an area of (1×1) cm^2 and placed in the upper part of the containers. A CR 39 piece of the detector was placed at the bottom of each tube cover, with samples at the bottom of tube, and then sealed for exposure for 4 months in a refrigerator [2]. Figure 1: shows the container for measuring alpha concentration.

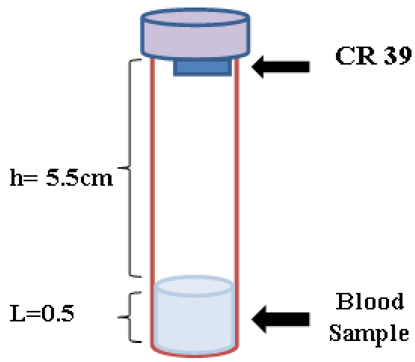

Figure 1: Container for measuring alpha concentration

At the end of the period CR-39 detector was etched with sodium hydroxide (NaOH) solution (62.5 gm.) with 250 ml distilled water at 60°C for 5 hours. Solution normality was 0.25 N in the water bath. The detectors were then washed using distilled water. Track density as detected by the CR 39 detector (track/cm^2) was computed using an optical microscope (Olympus Japan) with a magnification of 40X. The correction for background was conducted by subtracting background from the recorded alpha track density. After chemical etching the CR-39 detectors were washed in distilled water then dried in the air. The number of uranium atoms (^{238}U) of the sample (N_U^S)at secular equilibrium can be obtained as follows [13]:

$$N_U^S = \frac{A_{Rn}^S}{\lambda_U} \ldots \ldots ..(1)$$

Where λ_U is the uranium decay constant (4.9×10^{-18} s^{-1}). Hence, uranium weight (g) in the sample M_U^S can be estimated as follows(Wong,2008):

$$M_U^S = \frac{N_U^S \, A_U}{N_A} \ldots \ldots ..(2)$$

Where A_U is the mass number of ^{238}U, and N_A is Avogadro's number. Thus, the concentration of uranium C_U^S in ppm can be calculated as:

$$C_U^S(ppm) = \frac{M_U^S}{M^S} \ldots \ldots ..(3)$$

Where M^S: is the sample mass (gm).

3. Result And Discussion

Table 2: According to equation (3) shows the uranium concentrations in blood samples collected from breast cancer patients, the maximum value (2.235±0.08) ppm. The minimum value of uranium concentrations (1.034±0.02) ppm. The mean value of uranium concentrations in blood samples of breast cancer patients (1.7901±0.031) ppm.

Table 2: Uranium concentration (ppm) in blood samples of the cancer patients group.

No.	Code of sample	U_C (ppm)	No.	Code of sample	U_C (ppm)
1	C_1	1.034 ± 0.02	16	C_{16}	1.847 ± 0.02
2	C_2	1.292 ± 0.03	17	C_{17}	1.822 ± 0.02
3	C_3	1.589 ± 0.02	18	C_{18}	1.602 ± 0.04
4	C_4	1.628 ± 0.02	19	C_{19}	1.615 ± 0.02
5	C_5	1.692 ± 0.04	20	C_{20}	1.912 ± 0.03
6	C_6	1.654 ± 0.01	21	C_{21}	1.951 ± 0.02
7	C_7	1.744 ± 0.02	22	C_{22}	1.783 ± 0.05
8	C_8	1.744 ± 0.04	23	C_{23}	1.809 ± 0.04
9	C_9	1.679 ± 0.03	24	C_{24}	1.679 ± 0.01
10	C_{10}	1.744 ± 0.01	25	C_{25}	1.977 ± 0.02
11	C_{11}	1.796 ± 0.02	26	C_{26}	2.054 ± 0.06
12	C_{12}	1.912 ± 0.07	27	C_{27}	1.912 ± 0.02
13	C_{13}	1.783 ± 0.04	28	C_{28}	2.235 ± 0.08
14	C_{14}	2.002 ± 0.01	29	C_{29}	2.041 ± 0.03
15	C_{15}	1.938 ± 0.02	30	C_{30}	2.235 ± 0.02
Mean ± SD		1.7901±0.031			
Max± Std. Error		2.235±0.08			
Min± Std. Error		1.034±0.02			

Table:2 According to equation (3) shows the concentrations of uranium in blood samples collected from the Healthy group, where the maximum value (1.163 ± 0.01)ppm The minimum value (0.258±0.03) ppm with the mean value (0.7764±0.019) ppm.

Table 3: Uranium concentration (ppm) in blood samples of the healthy group.

No.	Code of sample	U_C (ppm)	No.	Code of sample	U_C (ppm)
1	H_1	0.620 ± 0.01	16	H_{16}	0.388 ± 0.03
2	H_2	0.711 ± 0.03	17	H_{17}	0.723 ± 0.02
3	H_3	1.072 ± 0.03	18	H_{18}	0.904 ± 0.01
4	H_4	0.646 ± 0.02	19	H_{19}	0.646 ± 0.02
5	H_5	0.904 ± 0.01	20	H_{20}	0.220 ± 0.01
6	H_6	0.388 ± 0.02	21	H_{21}	1.163 ± 0.01
7	H_7	1.176 ± 0.01	22	H_{22}	0.426 ± 0.03
8	H_8	0.258 ± 0.03	23	H_{23}	1.034 ± 0.01
9	H_9	0.646 ± 0.01	24	H_{24}	0.749 ± 0.03
10	H_{10}	0.685 ± 0.03	25	H_{25}	1.292 ± 0.01
11	H_{11}	0.517 ± 0.01	26	H_{26}	1.137 ± 0.02
12	H_{12}	0.775 ± 0.01	27	H_{27}	0.982 ± 0.01
13	H_{13}	1.163 ± 0.03	28	H_{28}	1.163 ± 0.02
14	H_{14}	0.711 ± 0.01	29	H_{29}	0.581 ± 0.01

15	H_{15}	0.659 ± 0.01	30	H_{30}	0.956 ± 0.02
Mean ± Std. Error		0.7764±0.019			
Max± Std. Error		1.163 ± 0.01			
Min± Std. Error		0.258±0.03			

Uranium concentrations in the patient group and the healthy group is shown in Table (2),(3) and Figure(2) The mean value of uranium concentrations in the blood samples of the group of patients is higher than that of the healthy group. Based on these average values, These results indicate that patients with breast cancer were exposed to high levels of radioactive Uranium by inhalation and ingestion from the contaminated environment in the areas affected southern Iraq. Study group results Above the permissible limit of the International Organization for the Protection of Radiation (0.115 ppm) [10]. The pollution of the environment with radiation is the reason behind the high concentration of uranium in the biological samples of after the Gulf War [6].

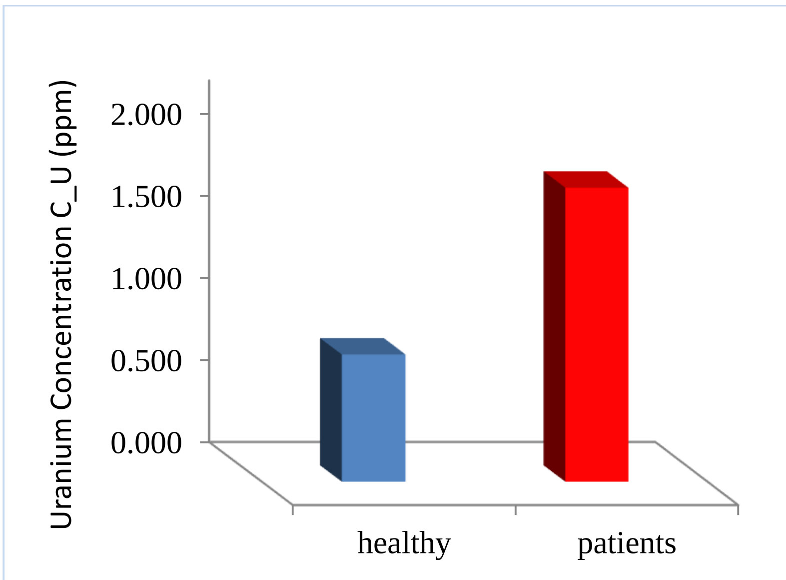

Figure 2: Average values of uranium concentrations in blood samples of the study Groups.

Table 4. and Figure 3. shows the uranium concentrations in blood samples and the healthy group as a function of age groups. According to Table 4.4, it was found that the average values of uranium concentrations increase with age groups. Explaining these results, the participants were divided into four age groups: (20-32)year (33-45) year (46-58) year (59-71) year. According to Table 4.4, it was found that the mean the values of Uranium concentrations in blood samples increase with the age group. The average concentration of uranium at the age of more than 59 years (1.934 ±0.029)ppm, which is higher than the age of (46-58)year (1.838 ± 0.029)ppm and higher than that for age (33-45)year (1.684 ± 0.025)ppm, and it is also higher than the age of (20-32)year (1.163 ± 0.023)ppm. This indicates a significant increase in uranium concentration with age. Likewise for the healthy group, uranium concentrations increase, but are less than group of patients with age group the average concentration of Uranium at the age of more than 59 years (0.964 ± 0.018) ppm is higher than the age of (46-58) year (0.754 ± 0.019) ppm as it is higher than the age of (33-45) year (0.736 ± 0.018) ppm and it is higher than the age of (20-32) year (0.722 ± 0.022) ppm. The increase in uranium concentration with age is also predicted by the ICRP model [9] for uranium under conditions of a continuous level of uranium consumption. The reason behind the increase of uranium with age can be attributed to the dietary intake and the accumulation of uranium in the body, which will be increased as a function of the exposure period. The concentrations of uranium increase with the increase in

the life of the individual as found [18] Long – term effects may appear as a result of a chronic low – level exposure over a long period. These include genetic effects and other effects such as cancer.

Table 4: Uranium concentrations in blood samples of the Healthy group and Patient Group According to age group.

Age group	Healthy Group U_C (ppm)	No. individual	Patient Group U_C (ppm)	No individual
20-32	0.722 ± 0.022	8	1.163 ± 0.023	2
33-45	0.736 ± 0.018	7	1.684 ± 0.025	8
46-58	0.754 ± 0.019	10	1.838 ± 0.029	8
59-71	0.964 ± 0.018	5	1.934 ±0.029	12

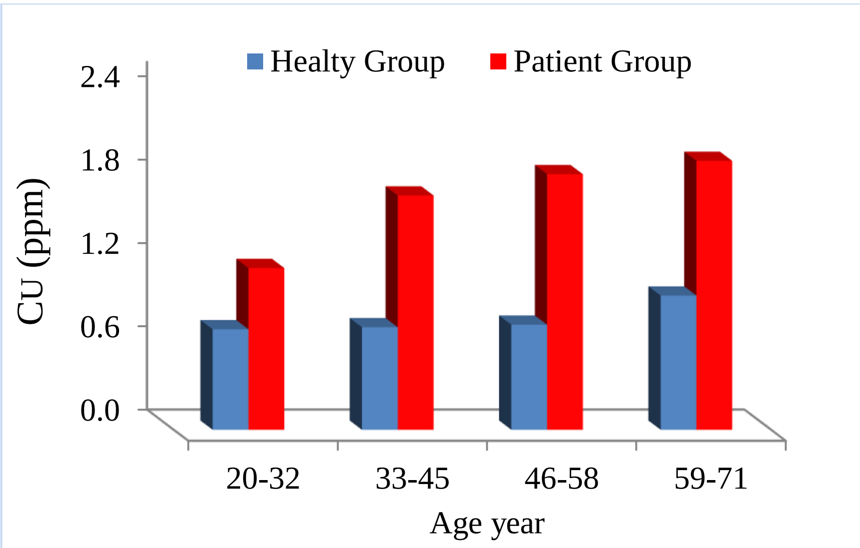

Figure 3: Uranium concentrations in blood samples of the Healthy group and Patient Group According to age group.

4. Comparison With Other Results

In this study, uranium concentrations ranged in blood samples for both groups (0.7764 ±0.019) ppm for Healthy group (1.7901±0.031) ppm for Patient group. Other studies have varied uranium concentrations in blood samples in different regions. The study in Al-Muthanna Governorate, It ranged between(0.073- 1.84) ppm (Saja,2006). In another study in Baghdad, uranium concentrations in the blood ranged between(0.077- 1.67)ppm (Essam,2016). The table.5 summarizes the uranium concentrations in blood samples in other studies.

Table 5: A comparison between uranium concentrations (ppm) in blood samples with other studies.

Place	Uranium concentration	Reference
Iraq	0.073- 1.84	[8]
Iraq	0.05- 0.8	[4]
Iraq	0.077- 1.67	[14]
Iraq	0.008 – 0.44	[12]
Iraq	0.117-1.22	[1]
Iraq	0.7764 - 1.7901	Present Study

5. Conclusion

The average values of uranium concentrations in blood samples of patients were higher than healthy. There is a cumulative relationship between years age and uranium concentrations for patients and healthy group that's mean increasing years of age increase uranium concentrations. Study group results Above the permissible limit of the International Organization for the Protection of Radiation (0.115 ppm).

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