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Calculation of Uranium Concentrations in the Blood of People with Diabetes in (Salah al-Din / Dhuluiya) using the CR-39 Nuclear Impact Detector

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Abstract

A study was conducted to measure the concentration of uranium in Al-Duluiya District, Salah Al- ddin Governorate. The study looked at a number of people of both sexes (both men and women), with volunteers with diabetes (46), 30 men and (16) women, as well as smokers (23) and non-smokers (23) and by calculating the uranium concentration in blood samples from diabetic patients (2.31 µg/L), the percentage was traced back to smoking men aged (72) years, with the second highest percentage of uranium concentration in blood. The lowest uranium concentration in blood samples was (2.1 µg/L) for a male smoker aged (70 years) and for a non-smoking female aged (32 years) The value is (0.82 µg/L),Comparing the results from sick and healthy individuals with the highest and lowest concentration results from the blood samples examined, we found that the average concentration of uranium in diabetics was 1.18 micrograms/liter and in healthy individuals was 0.93 micrograms/liter, Shows that uranium concentrations increase more than in healthy people due to areas that have seen many wars and fighting leading to an increase in the proportion of the population suffering from various diseases such as cancer, kidney damage and diabetes.

Keywords: *Uranium, CR-39, Diabetics, Blood.*

1. Introduction

During the first Gulf War in 1991 and the 2003 invasion of Iraq, U.S. and British forces used depleted uranium munitions in densely populated areas, particularly in southern Iraq. This caused radioactive substances to contaminate the area. Aerosols and depleted uranium oxide are the principal sources of radiation, but other sources (like pieces of shattered armor) also include radionuclides generated by the uranium decay chain. Leaving that out. Radon and radium-226 are two examples. The source of -222 is contaminated soil that is still present close to these destroyed targets [1]. Even at low levels, the body is exposed to radiation over time and in proportion to the dose, according to clinical and pathological investigations on individuals and combatants in radiation-exposed areas. the dosage, point out any negative consequences. Complaints could happen. healthy. This influences a person's genetic make-up in addition to the type of radiation dose. These conditions include malignancies, autoimmune illnesses like leukemia, and cell-mediated immunity loss. Birth malformations and infertility can result from illnesses such lung, liver, colon, thyroid, diabetes, and chromosomal disorders [2].

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The primordial radionuclides that have always existed on Earth are uranium, radium, and radon. Through three distinct radionuclide chains, the radionuclides uranium-238 , uranium-235 , and thorium-232 release nuclear radiation and particles and decompose into other atomic nuclei. These radioactive nuclei are also present in extremely small numbers in the human organism and some foods. [3]. Three naturally occurring isotopes of uranium are significant for both the nuclear business and the mining of this material. These make up U238—the majority of the elements found in the Earth's crust.—as well as U^{235} and U^{234}—which make up a much lesser fraction. These isotopes have half-lives of 4.5 and 703 billion years, or 2.46 and 105 years, respectively[4]. With a density of 19.0 g/cm3, little radioactivity, and considerable chemical toxicity, uranium is a heavy metal [5]. DNA destruction, kidney damage, and lung cancer are a few of uranium's negative health impacts. For exposure to soluble and insoluble uranium compounds through ingestion and inhalation, the World Health Organization (WHO) and the majority of national regulatory organizations have established minimal, suggested, or permitted limits, with the general population ingesting no more than 0.5 g/kg body weight per day of soluble uranium compounds. 1 g/m3 via ingestion and breathing[6]. The World Health Organization restricts uranium content for healthy individuals to 0.1 g/L [7].

understanding of how radiation interacts with biological or inorganic materials. It is a broad field of study that draws on biology, chemistry, physics, and medicine. The entire body (direct effect) or specific tissues can be impacted by radiation and radiation emitters (radionuclides).

when consumed or inhaled, enters the body. Different forms of radiation can harm different types of tissue to varying degrees. All forms of ionizing radiation can have negative effects, including cancer. The energy content of alpha particles, beta particles, gamma rays, and X-rays determines their relative propensity to harm human health.How deeply they can pierce the tissue depends on their energy. It also establishes the damage that energy can inflict on tissue and the amount that can be provided to it directly or indirectly[8].

2. Materials and Methods

2.1. Sample collection

During the months of October and November 2022, biological samples were collected and divided into two groups: the first group consisted of individuals with diabetes, specifically those residing in the city of Al-Duluiya, which is located in Salahuddin Governorate. The second group represented healthy individuals.

Samples from the patient group were collected from Al-Duluiya General Hospital, where every patient was receiving care at the moment the sample was taken. In contrast, samples from people with no notable medical history were taken from the healthy group, also at the same hospital. Table (1) represents the main components of this study.

Table (1) Data of the two study groups

	Type of disease	NO. Samples
Blood	diabetic patients	46
	Healthy people	25

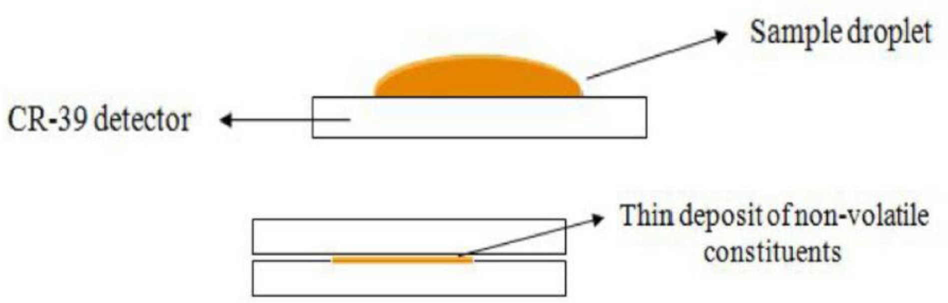

Figure 1: Blood samples

2.2 Experimental work

The impact detector CR-39, manufactured by Pershore Molding Ltd. in the UK, with a thickness of 500 mm, was used to record the traces of fragmentation. The detector sheets were cut into small pieces, each measuring 1.5 cm by 1.5 cm. These pieces were stored at room temperature.

Samples were irradiated at the Ibn Al-Haytham Institute of Pure Science Education at the University of Baghdad, where Americium-Beryllium (Am-Be) was used as a neutron source with a flux of $5*10^3$ neutrons per square centimeter per second ($5*10^3$ $n/cm^2/s$). This source emits fast neutrons.

Using a micropipette, two drops of blood (75µL) were placed on a square A CR-39 nuclear trace detector with an area of 1.5 cm × 1.5 cm. [9]. After the sample has dried at room temperature, another layer of detectors is placed on the sample surface to form a pair and the process is repeated for the remaining samples.

The detectors were removed from the solution after a 5-hour period and washed with distilled water. They were then left to dry, and subsequently, the examination was carried out under an optical microscope at a magnification of 400X to count the formed tracks on the detectors. Five readings were taken, The average number of trajectories per sample (Z) is obtained by dividing the average number of trajectories by the unit area of the lens used. This allowed for the determination of the density of the fragmentation tracks, as described in the following equation[10].

$$\text{Track Desity } (\rho_x) = \frac{\text{Average of total tracks (Nave)}}{\text{Area of Field view (A)}} \text{ -------- } (1)$$

where: ρx: the density of the effects (Track/ mm^2). Nave: Average of total effects within area (A). A: Area (mm^2).

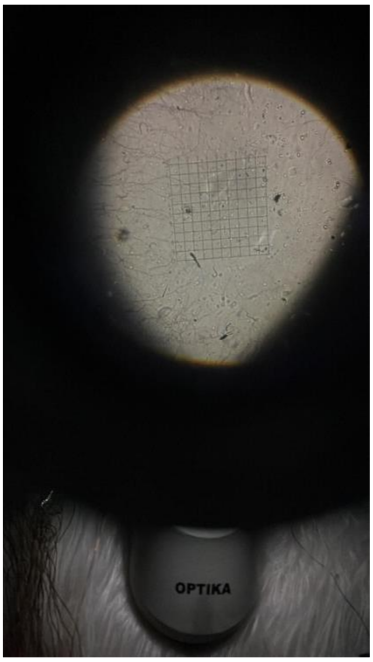

Figure 2: shows the traces of fission fragments formed on the surface of CR-39 detector for blood samples after examination with optical microscopy.

To measure uranium concentrations in blood samples of unknown concentration as follows[10]:

$$C_x = \left(\frac{\rho_x}{Slope}\right) - - - - - (2)$$

3. Results of uranium concentration in the blood

Where the study was conducted on many people of both sexes, males and females, as the number of models for people with diabetes volunteers (46) model, as the number of males 30 and the number of females (16) and the number of smokers (23) and the number of non-smokers (23), and by calculating the concentration of uranium in the blood samples of people with diabetes (2.31μg/L) and this percentage is due to a male person aged (72) years of smokers, while it ranked second for the percentage of uranium concentration in the blood Also for a male person aged (70) years of smokers, as it reached (2.1 μg/L), and the lowest value of uranium concentration in blood samples was (0.82μg/L) for a non-smoking female at the age of (32) years, Table (2) and fig(3) shows the comparison of the results between sick and healthy people to the highest and lowest concentration of the results of the studied blood samples, where we note that the average concentration of uranium for people with diabetes (1.18μg/L) and healthy people (0.93), which indicates an increase in uranium concentration more than in healthy people, and the reason for this is that areas witnessing multiple wars and battles lead to an increase in the percentage of people with various diseases such as (cancer, kidney disability and diabetes) and this is consistent [12].

Table 2 shows the comparison of results between sick and healthy people

Statically Value	Patients Group	Healthy Group
No .Sample	46	25
Max	2.3	1.2
Min	0.82	0.6
Mean ± Std. Error	1.18±0.34	0.93±0.12

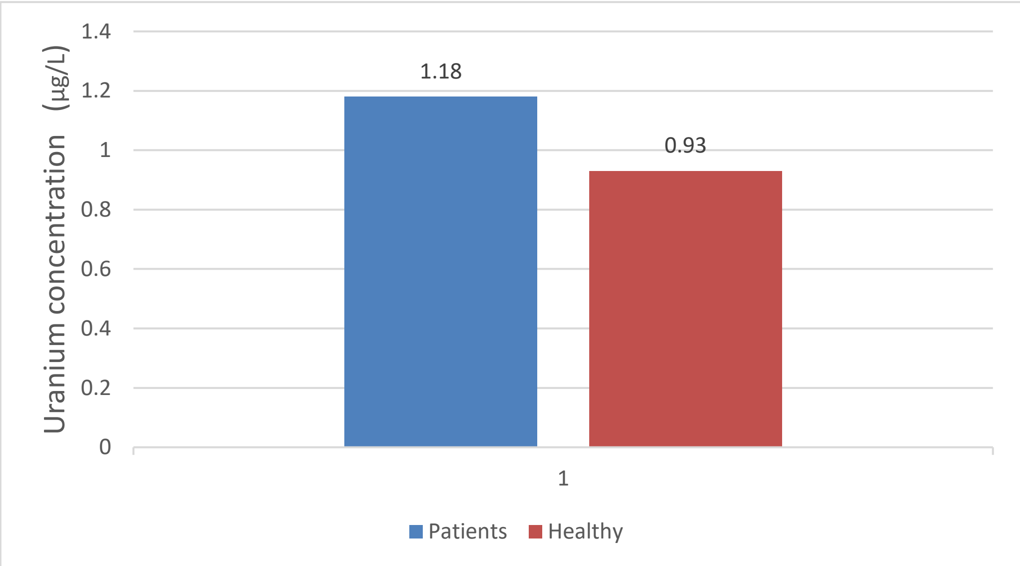

Figure 3: shows a diagram of the average concentration of uranium for the healthy and sick groups.

Table (3) shows the average concentrations of uranium for blood samples for infected persons for both males and females, as it is clear from the table that the average concentration of uranium in males is slightly higher than the concentration of females for people with diabetes, as for healthy people, the average concentration of uranium in blood samples for females is slightly higher than the DHKO as shown in Figure (4) and this reason is due to the rates of blood presence in females less than males [12].

Table (4) shows the average concentration of uranium as a function of sex (male and female)

Classification	Gander	No of Subject	Mean ± Std. Error
Patients Group	Male	30	1.185±0.342
	Female	16	1.194±0.351
Healthy Group	Male	17	0.947±0.127
	Female	8	0.921± 0.144

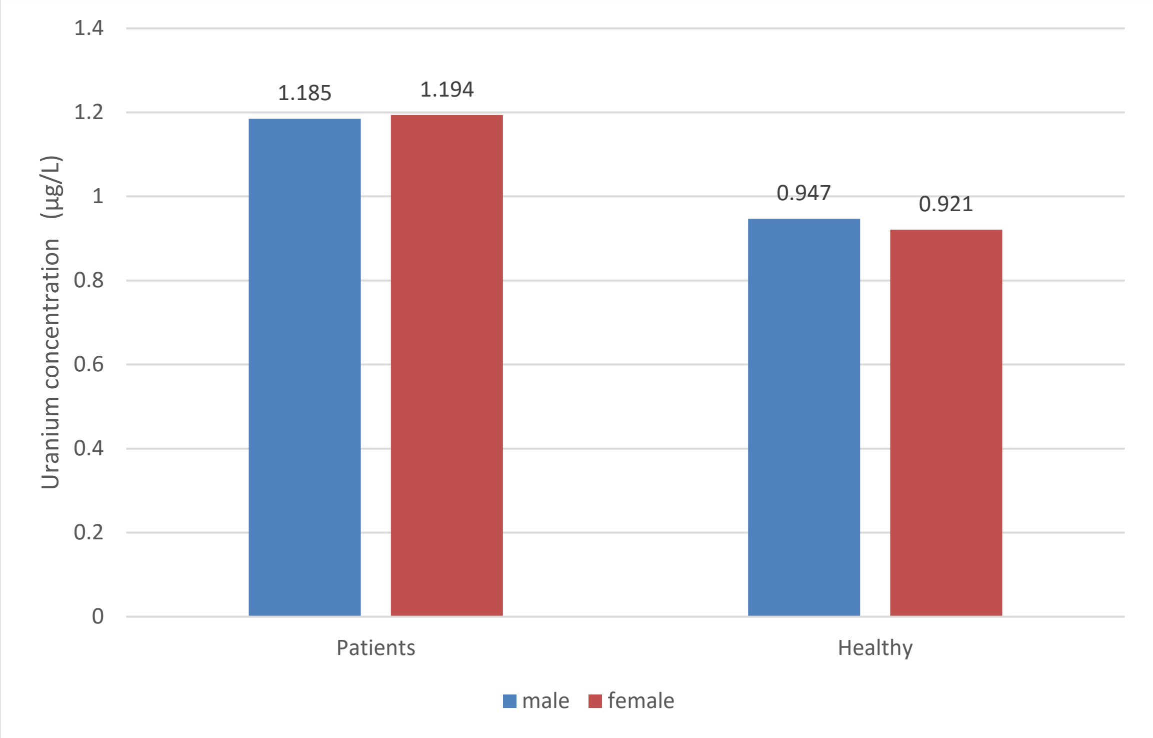

Figure 4 shows a diagram of the average concentration of uranium as a function of sex (male and female)

4. The conclusions

The concentration of uranium in the blood samples of people with diabetes was studied, where through the study it was concluded that people with diabetes had a higher uranium concentration ratio (2.31) than healthy people (2.3) as well as that the age of the people also had a role in the process of increasing uranium concentration The older people found that they have a greater uranium concentration than younger people, as well as the sex of the person also has a large role, it was found through the study that the concentration of uranium In men it is higher than in females.

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