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Uranium Concentrations in Urine of Maternal Samples in Baghdad Governorate

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Abstract

The trace concentration of uranium in urine samples for pregnant women and non- pregnant women were determined using fission track technique with CR-39 track detector that is employed for registration of induced fission tracks. A total of 32 urine samples were collected from Yarmouk Teaching Hospital, Department of Obstetrics and Gynecology for Pregnant women and 5 urine samples were collected from Different regions of Baghdad governorate. The results show that the uranium concentration in urine of Pregnant women were ranged from 0.58 $\mu\text{g/l}$ (30 years old, living in AL- Shurta AL khamisa region) to 1.58 $\mu\text{g/l}$ (23 years old living in AL-Doura region) with average $0.92 \pm 0.2 \mu\text{g/l}$. While for non-Pregnant women, uranium concentration ranged from 0.61 $\mu\text{g/l}$ (24 years old, living in AL-Doura region) to 1.16 $\mu\text{g/l}$ (40 years old, living in AL-Ghazaliya region) with average $0.874 \pm 0.19 \mu\text{g/l}$. It was found that the average uranium concentrations in urine samples for pregnant women living in Hayi AL-maealif region higher than other regions in Baghdad governorate.

Key words: Fission Track Technique, CR-39 track detector, Pregnant women, Urine sample, Uranium concentration.

Introduction

Uranium is a very common radioactive element and occurs in various low concentrations, in all forms of rocks. It is widely distributed at a level of around 2–4 ppm in Earth's crust, rocks, and soils [1]. The greatest radiation danger to humans arises when the inhalation or ingestion of uranium compounds. Uranium is incorporated into the human body mainly through the ingestion of food, water and the inhalation of air [2,3]. Uranium toxicity is determined by its chemical and radioactive properties. In general the more soluble the compound of uranium is the more poisonous it becomes. More soluble uranium compounds are of low to moderate toxicity while highly toxic are soluble compounds. Hexavalent uranium, which forms soluble compounds, is typically more toxic than tetravalent uranium minerals which are less soluble [4].

Uranium absorbed into the systemic circulation of the body is mostly excreted through the renal system within a short time. The remainder is stored in different organs as described above and is also excreted through urine within a prolonged half-life [5].



The principal sites of uranium deposition in the body are kidneys, liver and bones. The presence of higher levels of uranium in the human body affects renal function and can lead to kidney failure at very high concentrations. [1]

The daily intake of uranium from natural sources is estimated at 0.001, 0.6 and 2 μg , respectively, from air, water, and food. Thus the total daily intake for a 60 kg adult is approximately 2.6 μg [6], [7]. When uranium is consumed in food or drink, the bulk of the uranium absorbed will be excreted in urine within a few days. Small amounts of uranium, however, are taken up and stored by bone and other tissues, and released only slowly [5, 8].

The aim of the present work is to determination of uranium concentrations excreted in urine of Pregnant-women samples living in different regions in Baghdad governorate. The comparison will base on some important parameters (e.g. age, living region).

Material and Methods

In this study, 32 urine samples for pregnant women, were taken from Yarmouk Teaching Hospital, Department of Obstetrics and Gynecology, and 5 urine samples for non- pregnant women taken from Different regions of Baghdad governorate.

Uranium concentration in urine samples were determined using fission track technique with CR-39 track detector.

CR-39 nuclear track detector sheets of 500 μm thick were cut into small pieces each of $(1 \times 1) \text{ cm}^2$ area.

Two drops of urine of known volume 100 μL of urine were dried on CR-39 piece detector in a dust-free atmosphere at normally room temperature. The urine sample was left over the detector until dried in the form of a thin film and then covered with another piece of detector to make it pair.

All pairs of detectors were then irradiated with thermal neutrons from (Am-Be) neutron source with thermal neutron fluence $3.024 \times 10^9 \text{ n.cm}^{-2}$.

The induced fission track were obtained according to the ^{235}U (n,f) reaction [9]. After the irradiation, CR-39 detectors were etched using 6.25 N NaOH solution at temperature 60°C for 5 hours, after the chemical etching the detectors were rinsed in distilled water and dried. The fission track densities were recorded using an optical microscope at magnification of 400x.

Results and Discussion

Uranium concentration in urine samples were measured using the relation

$$\frac{U_x}{U_s} = \frac{\rho_x}{\rho_s}$$

Where U_x and U_s are the uranium concentration in unknown and standard samples, ρ_x and ρ_s the track density in unknown and standard samples [10].

The results of uranium concentration in urine samples for pregnant women was shown in Table 1. The uranium excretion in the urine samples varied from 0.58 to 1.58 $\mu\text{g/l}$ with average 0.937 ± 0.22 $\mu\text{g/l}$. The higher concentration were found in woman 23 years old living in AL-Doura region and the lowest concentrations in AL Shurta AL khamisa region.

Uranium concentration in urine samples for non-pregnant women was shown in Table 2. The uranium excretion in the urine samples varied from 0.61 to 1.61 $\mu\text{g/l}$ with average 0.874 ± 0.19 $\mu\text{g/l}$. The higher concentration were found in woman, (40 years old) living in Al- ghazaliya region. The lowest concentration were found in woman (24 years old) living in Al- Doura region as shown in Figures.1 and 2.

Table 1: Uranium Concentrations in urine Samples for Pregnant Women in Baghdad Governorate

| Sample code | Region | Age (year) | Gestational age (Month) | Uranium Con. ($\mu\text{g/L}$) |
|--------------------|----------------------|-------------------|--------------------------------|--|
| M1 | AL-Radwaniyah | 19 | 9 | 0.644 |
| M2 | Hayi ALamil | 28 | 9 | 1.059 |
| M3 | AL-Youssoufia | 18 | 9 | 1.09 |
| M4 | AL-Youssoufia | 19 | 9 | 1.023 |
| M5 | AL-Radwaniyah | 40 | 9 | 0.92 |
| M6 | AL-Youssoufia | 30 | 9 | 1.11 |
| M7 | AL- Biae | 20 | 9 | 0.75 |
| M8 | AL-Youssoufia | 22 | 9 | 0.812 |
| M9 | AL – Doura | 23 | 9 | 1.58 |
| M10 | AL- Mahmudiyah | 25 | 9 | 0.831 |
| M11 | Hayi AL'ielam | 39 | 1 (Projection) | 0.68 |
| M12 | AL Shurta AL khamisa | 30 | 9 | 0.783 |
| M13 | AL-Adhamiya | 17 | 9 | 1.017 |
| M14 | AL – Doura | 26 | 9 | 1.018 |
| M15 | AL- Mahmudiyah | 35 | 9 | 0.903 |
| M16 | AL – Doura | 23 | 9 | 0.624 |
| M17 | AL- Ghazaliya | 38 | 3 (Projection) | 0.797 |

| | | | | |
|---------|----------------------|----|----------------|----------|
| M18 | AL shurta AL khamisa | 30 | 9 | 0.58 |
| M19 | AL- Biae | 29 | 9 | 1.21 |
| M20 | AL-Radwaniyah | 30 | 9 | 0.773 |
| M21 | Abu-Ghraib | 21 | 9 | 1.013 |
| M22 | AL-Saydia | 32 | 9 | 1.12 |
| M23 | AL-Saydia | 33 | 9 | 0.917 |
| M24 | Abu-Ghraib | 27 | 9 | 0.884 |
| M25 | Hayi ALamil | 38 | 9 | 0.79 |
| M26 | Hayi AL'ielam | 22 | 9 | 0.816 |
| M27 | AL-Doura | 28 | 9 | 0.704 |
| M28 | AL-Doura | 19 | 3 (Projection) | 0.88 |
| M29 | AL-Salihiya | 27 | 9 | 0.75 |
| M30 | AL-Doura | 29 | 9 | 0.79 |
| M31 | AL-Suwib | 43 | 9 | 1.1004 |
| M32 | Hayi-ALmaealif | 27 | 9 | 1.19 |
| Average | | | | 0.92±0.2 |

Table 2: Uranium Concentrations in urine Samples for non-Pregnant Women in Baghdad Governorate

| Sample code | Region | Age (year) | Uranium con. (µg/l) |
|-------------|--------------|------------|---------------------|
| A1 | AL-Doura | 24 | 0.61 |
| A2 | AL-Adhamiya | 30 | 0.74 |
| A3 | AL-Ghazaliya | 40 | 1.16 |
| A4 | AL-Yarmouk | 41 | 0.82 |
| A5 | AL-Saydia | 35 | 1.04 |
| Average | | | 0.874±±0.19 |

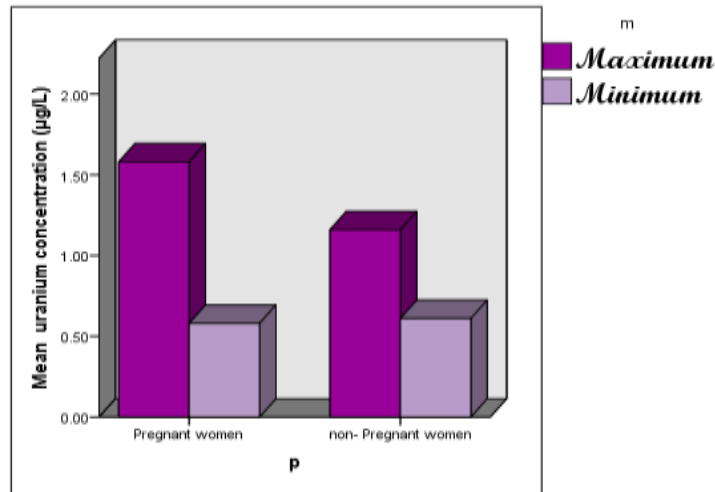


Figure 1: Maximum and Minimum of Uranium Concentration for Pregnant and non- Pregnant Women's

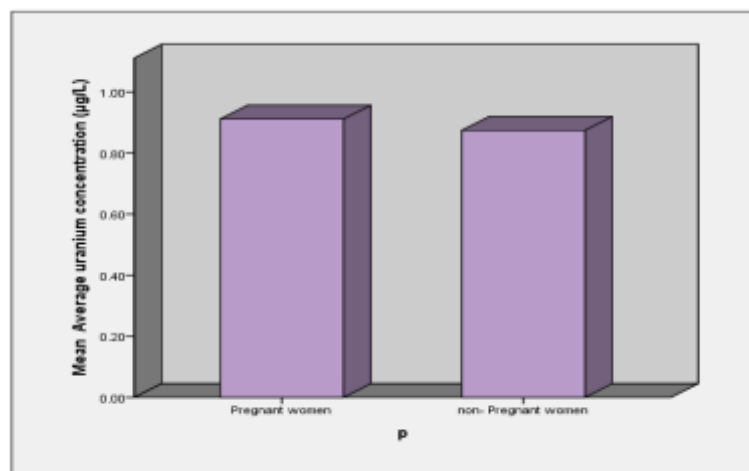


Figure2: Average Uranium Concentration for Pregnant Women and Non-Pregnant Women

Figure 3 shows the average uranium concentrations in urine samples at different regions of Baghdad governorate, which shows that the maximum of uranium concentration for pregnant women was 1.19 µg/l in Hayi AL-maalif region and the minimum concentration was 0.682 µg/l in AL-Shurta AL-Khamisa.

Figure 4 shows the average uranium concentration in urine samples at different regions of Baghdad Governorate for non-pregnant women, which shows that the maximum of uranium concentration was 1.16 µg/l in AL-ghazaliya and minimum concentration 0.61 µg/l in Al-Doura.

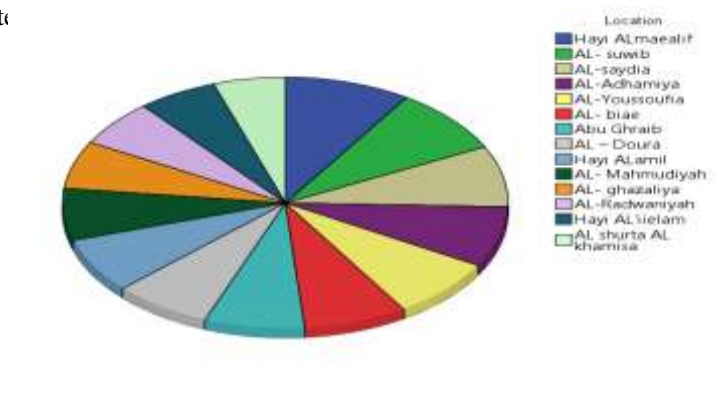


Figure 3: Average Uranium Concentration in Urine Samples for Pregnant Women at different Regions in Baghdad Governorate

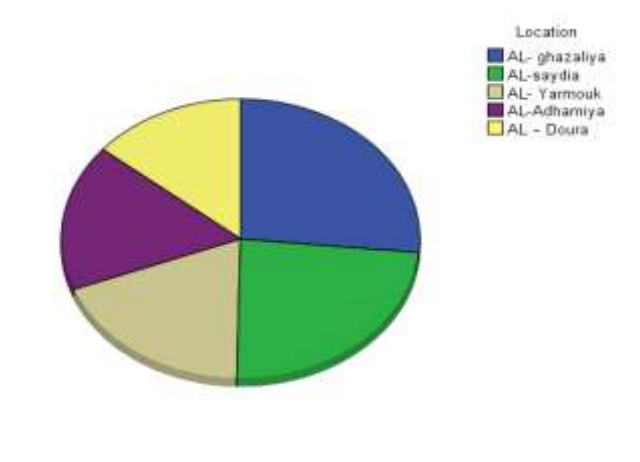


Figure 4: Average Uranium Concentration in Urine Samples for Non-Pregnant Women at different Regions in Baghdad Governorate

Table 3 and Figures (5,6) show the average of uranium concentrations in urine samples for pregnant women and non-pregnant women according to the age.

It was found that the following divisions were the most appropriate, as it provides an acceptable statistical number in each group, for pregnant women (1A) (17-21) years, (1B) (22-26) years, (1C) (27-31) years (1D) (32-36) years and (1E) (37-41) years, for non-pregnant women group : (2A) (22-26) years ,2B(27-31) years, (2C) (32-36) years, (2D) (37-41) years, 1F above 41 year.

The uranium concentration in urine of the study group may result from the food and dusty climate condition in Baghdad governorate slightly higher uptake and thereafter excretion of uranium in urine might occur through inhalation of additionally suspended dust in the air.

Table 3: Average Uranium Concentrations in urine Samples for Pregnant and Non-Pregnant Women in Baghdad Governorate according to Ages

| Classification | Group | Age (year) | No. of Female | Average Uranium Conc.($\mu\text{g/l}$) |
|--------------------|-------|------------|---------------|--|
| Pregnant Women | 1A | 17-21 | 7 | 0.916 \pm 0.15 |
| | 1B | 22-26 | 6 | 0.943 \pm 0.3 |
| | 1C | 27-31 | 11 | 0.89 \pm 0.2 |
| | 1D | 32-36 | 3 | 0.98 \pm 0.14 |
| | 1E | 37-41 | 4 | 0.796 \pm 0.08 |
| | 1F | Above 41 | 1 | 22.4 |
| Non-Pregnant Women | 2A | (22-26) | 1 | 0.61 |
| | 2B | (27-31) | 1 | 0.74 |
| | 2C | (32-36) | 1 | 1.04 |
| | 2D | (37-41) | 2 | 0.99 |

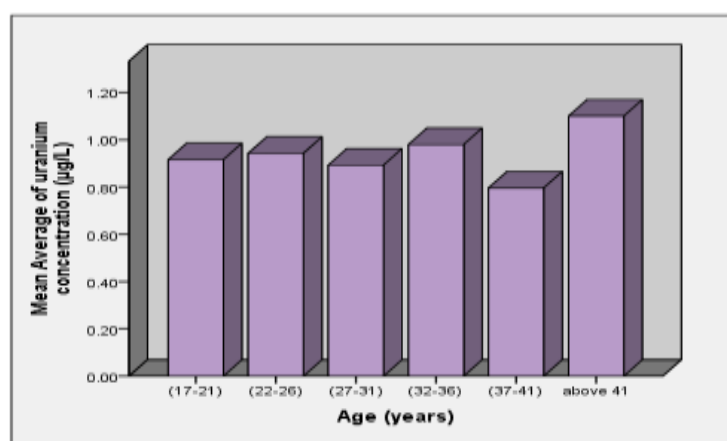


Fig. 5: The average of uranium concentrations in urine samples for pregnant women according to the age

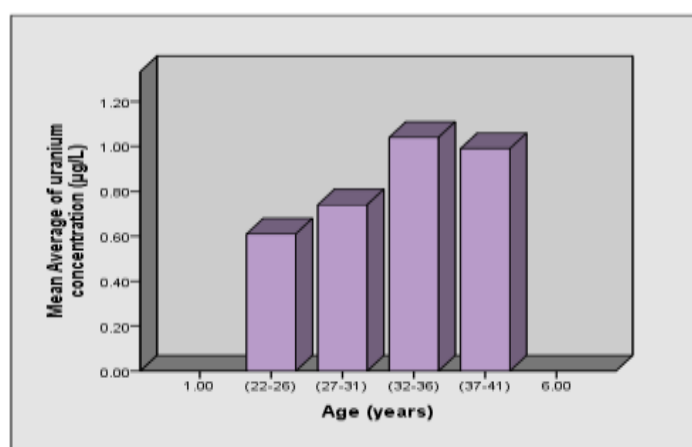


Fig. 6: The Average of Uranium Concentrations in Urine Samples for Non-Pregnant Women According to the Age

Conclusion

1. The lowest uranium concentration excreted in urine of pregnant woman were found in woman 30 years old, living in AL shurta AL khamisa region.
2. The highest uranium concentration excreted in urine of pregnant woman were found in woman 23 years old living in AL-Doura region.
3. From the results we found that the average uranium concentration for pregnant women higher than non-pregnant women.
4. It was found that the average uranium concentrations in urine samples for pregnant women living in Hayi AL-maalif region higher than other regions in Baghdad governorate.
5. It was found that the average uranium concentrations in urine samples for pregnant women living in AL-Shurta AL-Khamisa lower than other regions in Baghdad governorate.
6. The average of uranium concentrations excreted in urine samples for pregnant women according to the age group, was found that the highest concentration in (32-36) year group while for non-pregnant women found also in (32-36) year group.
7. The average of uranium concentrations excreted in urine samples for pregnant women according to the age group, was found that the lowest concentration in (27-31) year group while for non-pregnant women found in (22-26) year group.

Reference

- [1] Yongyang Wei , Qinghua Lin , Huawei Wang, Advances in Applied Microbiology, Uranium Bioreduction and Biomineralization,. 101, pp 137-168, 2017.
- [2] Priest N.D., Toxicity of depleted uranium, LANCET, 357, pp 244-246, 2001.
- [3] Agency for Toxic Substances and Disease Registry (ATSDR), "Toxicological Profile for Uranium", U.S. Department of Health and Human Services, Public Health Service, Atlanta, GA. 1999.
- [4] Armando Faa, Clara Gerosa, Daniela Fanni, Valeria M Nurchi, "Depleted Uranium and Human Health" Current Medicinal Chemistry, 24 (999):1-1, 2017.
- [5] International Commission on Radiological Protection (ICRP), "Age dependent Doses to Members of the Public from Intake of Radionuclides": Part 3 Ingestion Dose Coefficients. 25(1). ICRP Publication 69, Pergamon, Oxford, 1995.
- [6] World Health Organization (WHO), "Health Criteria and Other Supporting Information", 2, 2nd edn. WHO/EOS/98.1, Geneva, p 283, 1998.
- [7] Othman I, Al-Hushari M, Raja G., "Radiation Exposure Levels in Phosphate Mining Activities". Radiat Prot Dosim 45:197–201, 1992.
- [8] Leggett RW, "Basis for ICRP's Age-Specific Model for Uranium". Health Phys., 67:589–610, 1994.
- [9] Ammar A.Baattawy, Mohamad Suhaimi Jaffer, Eid Abdel Munem, Nada F. Tawfiq, Muwafaq Seham Mahde, Najeba Farhad Salih, "Uranium Concentration in Urine Using Fissio Track Technique" International Review of Physics(IREPHY) 6,4,380-386, 2012.
- [10] Ahmed F. Saleh, Mazin M. Elias, Nada F. Tawfiq, "Determination of uranium concentration in urine of workers in an Iraqi phosphate mine and fertilizer plants" J. Radioanal Nucl. Chem., 298:187–193, 2013.