Determination the infertility by impacts of alpha emitters on women urine

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Abstract

This research describes the results that have been obtained from the alpha particles after carrying out the present study. The study was conducted on 30 urine samples taken from women, who were either infertile, had weak fertility or had uterus tumor. The age of those women ranged between (21-43) years. The results showed that the low level of alpha emitters and the higher level of alpha emitters, values calculated in 20 ml of female urine samples were 0.726 ppm in Sedakan and 0.065 ppm in Shorsh, respectively. Thus, these areas do not represent a source of danger to human life. This denotes that there is no evidence of health problems. Significant difference found in participants' laboratory outcomes between Erbil and Sulaymania. Significant correlations ($p < 0.001$) found between participants' demographic data and their laboratory outcomes.

***Key Words*: infertility in women, Urine, Iraqi Kurdistan region, CR- 39NTDs, Alpha particles**

Introduction

The parts of our environment are the radiation and radioactive materials. Such materials have been produced by many human activities. Today, the common and valuable tool in medicine is radiation though hazards of ionizing radiation usually come from certain levels of radiation. Radon is the most important source for natural radiation that affects human bodies, (Dua et al. 2011). The concentrations of radon are determined by measuring the emitted alpha particles. Which cause damage (latent track) in the surface of the detector (Pires et al. 2007). Solid state nuclear track detector (SSNTDs) is one of alpha particle detectors that is used to measure radon's progeny.

In the present work, the technique of SSNTDs has been utilized for examining the samples of urine (Akoto et al. 2011). A special type of this technique is CR-39 NTDs, this detector has many advantageous characteristics, like, good sensitivity, stability against various environmental factors, and high degree of optical clarity. Accordingly, the researchers opined using it (Pires et al. 2007).

The measurement of uranium can be done in different environments, such as (air, soil, water) and on different biological samples, such as (lichens, urine, blood) (Zhu et al. 2009). Urine analysis and whole body counting have been used to measure levels of radon progeny in humans (Hussein A. S. 2008). Radon in human tissues is not detectable by adopting the routine medical testing. Testing such products is not generally and publically available (Tyburski et al. 2008). This process can be done by using the alpha particles detector, especially CR-39 NTD. Such a detector can be used in two different ways, the passive method (long term) and irradiation (short term) (Crawford et al 2008).

2-Materials and Research methodologies

2. 1. Materials

2.1.1 **Urine**

Urine is normally yellow-amber in color, though it depends on diet and the concentration of the urine. The smell or "odour" of urine may provide information about the health of an individual. Fresh urine typically has a mild smell while aged urine has a stronger smell similar to ammonia (Shaima'a 2009). The pH of normal urine is generally in the range 4.6 - 8, and an average of 6.0. The disparity in ph value is due to food nutrition. For instance, high protein diets leads to more acidic urine while vegetarian diets generally produce more alkaline urine both within the typical range 4.6 - 8. The density of normal urine is in the range of 1.001 to 1.035g/m3. (Shaima'a 2009).

2. 1.2 CR-39NTDs

The CR-39 plastic track detector is a $C_{12}H_{18}O_7$ polymer with a density of 1.31 g cm^{-3}, which is Columbia Resin (Zhu et al. 2009). The detector used in the present study is the ideal detector; it is produced by the Intercast Europe SRL (43100 Parma, Italy).The rectangular piece of the NTD is 10×15×0.7 mm^3 in size. The Intercast CR-39 has a low background for a small etching process that can be used in radon dosimetry (SEK et al. 2006). The sensibility of CR-39 is such that it is physically able to register the low energy alphas. Its high degree of reproducibility from batch to batch ensures the correct determination of the background signal. The latter gives an accurate estimate of the actual radon concentration (Obed et al. 2011)

2. 1.3 Tube technique (PVC)

PVC tube is a plastic cylinder, made from PVC (Poly Vinyl Chloride). It is a cylinder that is 2mm thick, of 2.1cm diameter and 10.5 cm long. It has been used in this work to determine the concentration of alpha emitter in the urine samples.

2. 2. Area under study

The study area is located in the Northern part of Iraq including some location from two big governorates of Kurdistan region (Erbil, Sulaymania). This study covered most parts of Iraqi Kurdistan and Kurdish provinces and the suburbs including Erbil and Sulyamania. This region has cold atmosphere and is snow mountainous, and this part contains the uranium series and emit the alpha particles at the decay, and lives in there, a lot of women had problems in infertility. Iraqi Kurdistan is contain comprise around 40,000 square and have a population of around 4 million.

2. 3. Research methodologies

2. 3.1 Samples collection

Urine samples have been collected from two selected governorate states in Iraqi Kurdistan. The sample consisted of 60 women, who have weak fertility, are infertile, or have tumor in uterus The age of these women ranged between 21-43 years, with 30 normal women (control). An amount of 20 mL of urine has been obtained from each of sixty women using clean plastic containers. The whole process was done in the hospital of Doctor Shahed Khaled in Koya. This hospital represents the medical authority in Kurdistan region in Iraq. Then, the collected samples have been brought to the research clinic at the end of the study to be labeled. Later, they were stored at 4 °C (Tsivouet et al. 2009), in the refrigerator of the hospital, particularly. The samples were collected on a daily basis and put in multiple. Then, each container was analyzed separately**.**

2. 3.2 Sample preparation

These samples have been weighted before being analyzed, each was 20 g /20 ml. Later, there were put in PVC containers of the volume 36.349 cm^3. Sample preparation was done after bringing the urine sample in ambient temperature (Agata 2009). Urine was used in this work with 90 detectors of the type CR-39NTDs. The sizes of the detectors were 10×15×0.7 mm^3. Then, the radon dosimeters were placed inside a PVC tube has 10.5 cm height and 1.05 cm radius. The detectors were immersed in the urine samples and hung inside the PVC tube. Then, the tubes that contained the urine samples with detectors were stored for 60 days in the fridge of the hospital. The purpose behind the storage was to ensure the samples reach an equilibrium state for the radionuclides that exist in the samples. From (11 June 2011 to 11 August 2011), the samples were sealed and were kept unshaken under 4 °C as shows in Fig. 1.

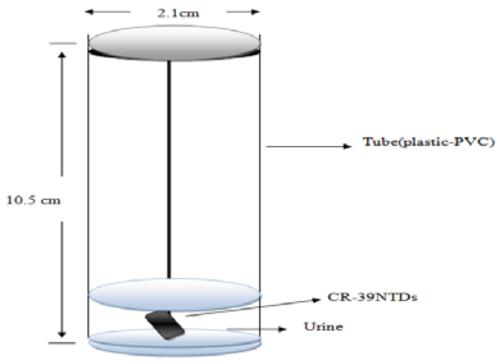

Fig. 1: PVC tube containing in urine and detector CR-39.

2. 3. 3 Etching process and scanning process

After completing the exposure time of 60 days, the detectors were removed from the PVC tube. All the dosimeters were collected at the end of the time exposure, etched chemically in a 6.25N NaOH solution at 70 ± 0.5 ◦C for 8 hours (Milenkovi 2010). A water bath Gotecg test in G machines Inc. of the model GT-7039-M, 220 V, 50 Hz was used to display and enlarge the latent alpha tracks due to radon decay (Saad et al. 2010). Chemical etching is the simplest and the most widely used technique in revealing the latent damage trails, resulted from ionizing the particles in solids. After that, the detectors were washed in distilled water; an optical microscope at 400X was used for scanning each detector (Saad et al. 2010).

The concentrations of alpha emitters in the urine samples were measured by comparison between track densities registered on the detectors and that of the standard urine sample from the relation (Shaima 2009).

$$C_X \text{ (sample)} / \rho_X \text{ (sample)} = C_S \text{ (standard)} / \rho_S \text{ (standard)}$$

$$C_X = C_S \cdot (\rho_X / \rho_S)$$

Where:

C_X : uranium concentration of urine in unknown sample (ppm).

C_S : uranium concentration of urine in standard sample (ppm).

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

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

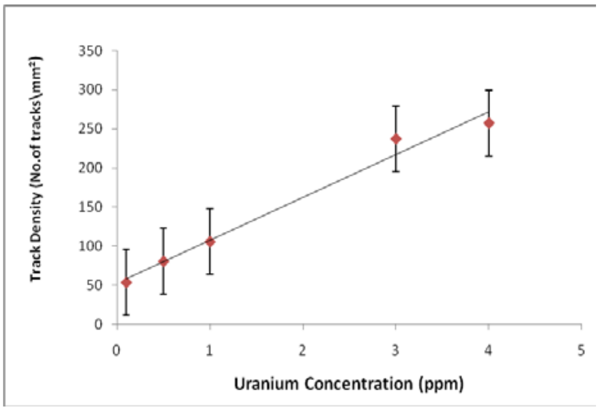

Fig. 2: The relation between track density and uranium concentration of standard urine samples.

Statistical analysis

All statistical calculations were performed using SPSS for Windows, Standard version 20.0. The data of the research were saved in Microsoft excel spread sheet and analyzed on the computer using Microsoft excel program, post-hoc LSD, One way a nova and Independent t test methods used in this analysis. Also the result of the study was explained by statistical SPSS analysis.

3. Results and discussion

Urine assay is the preferred method for monitoring alpha particles that emit into the human body from the radon decay and progeny. It is a valuable technique that helps evaluate the levels of alpha naturally in urine samples.

Urine as part of an epidemiological Survey is used to determine public exposure to natural radiation and to estimate radionuclide level, in a high level back ground radiation, it is important to use urine to determine the extent of the public exposure to natural radiation. It further helps estimate the radionuclide levels in the highly radiated area of Kurdistan in Iraq, therefore, it is used in this study. The ^{222}Rn concentrations were determined in 30 urine samples by using the CR-39 NTDs counting technique. It was noted that the maximum and minimum values of concentrations of alpha emitters in 20 ml of urine were 0.726 ppm in Sedakan and 0.065 ppm in Shorsh, respectively, as shown in Tables 2 and 3. The results showed that the concentration of alpha emitters varied from woman to another, depending on the extent to which women's bodies were allergic to the radiation, the age of women, the geological formation of the area being studied, and the exposure period (Rafique et al, 2010).

Urine in Erbil and Sulaymania cities

1- Demographic characteristics of participant in Erbil and Sulaymania

There were 60 women from Erbil and Sulaymania, 30 in each governorate, enrolled in current study. The participants' mean age, years of marriage, weight was 33.23 ± 5.759 years, 10.37 ± 4.529, and 61.833 ± 5.198 respectively. Majority of them were functionary, with low incidences of smoking. The characteristics of other laboratory results were found in Table 1.

Table 1: Demographic and laboratory characteristics of women in Erbil and Sulaymania

Variables (60 participants)		% (no.) / Mean (± SD)
Age (years)		33.23 ± 5.759
Years of marriage (years)		10.37 ± 4.529
Weight (kg)		61.833 ± 5.198
Track density of fresh urine		22.171 ± 7.111
Conc. of alpha emitters in fresh urine		0.351 ± 0.113
Governorate	Erbil	50 % (30)
	Sulaymania	50 % (30)
Smoking	Yes	10 % (6)
	No	90 % (54)
Occupation	Housewife	38.3 % (23)
	Functionary	61.7 % (37)

2- Correlation between participants' demographic data and their laboratory outcomes

Significant correlations found between participants' demographic data and their laboratory outcomes, unfortunately no significant in any variables to the weight of participants, as shown in Table 2.

Table 2: Correlations between participants' demographic data and laboratory outcomes

Variables		Age (years)	Years of marriage	Weight (kg)
Track density of fresh urine	Pearson correlation	**0.761**	**0.642**	0.137
	p value	**<0.001**	**<0.001**	0.295
Conc. of alpha emitters in fresh urine	Pearson correlation	**0.760**	**0.642**	0.139
	p value	**<0.001**	**<0.001**	0.291

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

Differences in participants' laboratory outcomes between Erbil and Sulaymania

Significant difference found in participants' laboratory outcomes between Erbil and Sulaymania. The difference significantly revealed higher means of track density of fresh urine Erbil compared to Sulaymania, as shown in Table 3

Table 3 differences of participants' laboratory outcomes between Erbil and Sulaymania

Variables		Mean ± SD	Mean difference	*p* value
Track density of fresh urine	Sulaymania	20.884 ±3.745	-2.574	0.166
	Erbil	23.458 ±9.243		
Conc. of alpha emitters in fresh urine	Sulaymania	0.33 ±0.060	-0.041	0.162
	Erbil	0.372 ±0.147		

Independent t test

4- Differences between cases of governorates and normal cases

There was significant difference in all laboratory data between 2 governorates and normal cases, Erbil cases got the highest mean of laboratory data compared to others, as shown in Table 4.

Table 4: difference between governorates and normal cases in blood and urine laboratory data

Variable	Governorate	N	Mean	F	*p* value
Track density of fresh urine	Sulaymania	30	20.884 ± 3.745	17.283	**< 0.001**
	Erbil	30	23.458 ± 9.243		
	normal	30	14.456 ± 3.532		
Conc. of alpha emitter in fresh urine	Sulaymania	30	0.33 ± 0.06	17.190	**< 0.001**
	Erbil	30	0.372 ± 0.147		
	normal	30	0.229 ± 0.056		

One Way ANOVA

To find out the significant difference in laboratory data between each governorates' cases versus normal cases, post-hoc LSD used for parametric variables. Erbil cases had significantly higher means of all laboratory data than Sulaymania and normal cases. Sulaymania cases significantly had lower means of track density of fresh urine and fresh urine conc. of alpha emitters than cases of Erbil, but were higher than means of normal cases as shown in Table 5.

Table 5: Differences between governorates' and normal cases in urine data

Dependent Variable	Difference		Mean Difference	*p* value
Track density of fresh urine	Sulaymania	Erbil	- 2.574	0.106
		Normal	6.428	**<0.001**
	Erbil	Sulaymania	2.574	0.106
		Normal	9.002	**<0.001**
Conc. of alpha emitter in fresh urine	Sulaymania	Erbil	- 0.041	0.103
		Normal	0.102	**<0.001**
	Erbil	Sulaymania	0.041	0.103
		Normal	0.143	**<0.001**

LSD difference: the mean difference is significant at 0.05

Most health risks have come from the alpha particles that have been deposited in the body. Accordingly, it is highly recommended to keep the environment as secure and safe as possible. On the contrary, the high availability of uranium in some regions makes it a source of danger to the health of the public.

4. Conclusion

Most of the studied areas show the low level of alpha emitters and the higher level of alpha emitters, values calculated in 20 ml of female urine samples were 0.726 ppm in Sedakan and 0.065 ppm in Shorsh, respectively. Thus, these areas do not represent a source of danger to human life.

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