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Alpha Tracks Examination for Female Urine Samples who are Suffering from Urinary Tract Infections

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Abstract

Urine samples had been gathered from females living in Baghdad city. The sample consisted of 30 females who suffered from U.T.I (Urinary tract infections) and 20 healthy females. The type of urine U.T.I was specified by the emergency lab in Al-Kindy hospital, and alpha tracks were determined by the nuclear track detector CR-39. The concentrations of alpha in 30 urine samples taken from females who had U.T.I ranged from 0.327ppm-1.583ppm, with an average of 0.94965 ppm. The maximum value 1.583 ppm is belonging to females with an aged 57 years old. The results of healthy female concentration ranged from 0.022 ppm-0.459ppm with an average of (0.30855ppm). The findings revealed that alpha emitter concentrations differed from woman to woman, depending on the degree to which women's bodies were allergic to the radiation, according to their age. The finding revealed of patient female had higher concentrations than healthy females.

Keywords: Alpha Tracks, Nuclear track detector (CR-39), Radiation Exposure, Urinary Tract Infections, Urine samples.

Introduction

Radiation and radioactive substances are parts of our environment. These substances are produced by several human endeavours. Now, the valuable and common implement in medicine is the ionizing rays and the hazard that effect human tissue[1]. Human exposes to ionizing radiation from natural sources and sometimes from synthetic sources that come from human activities. The dangerous effect of ionizing radiation is the biological damage to Deoxyribonucleic Acid (DNA) or another part of the body[2]. The Types of radiation that effects human health is alpha, beta, gamma, neutron, and gamma rays, and each radiation has different properties[2]. The exposure to radiation from the radioactive nuclides can be divided into external and internal exposure; in general, for example, external exposure come from direct gamma ray, while mostly the interior exposure is result from the inhalation of radon and thoron with their other short life decay products[3]. The inhaled radon and its products go from the lungs into the blood and body tissues and may point to a lot of types of tissue cancers in lungs, kidneys, and prostatics[4]. Also, internal exposure comes from

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radioactive material that are entering the body by ingestion and inhalation of the naturally radioactive material in water, food and air[5]. Generally, radon concentration is measured by counting the released alpha particles that lead to spoil in the detector from outside[6]. The simplest and common detector for detecting alpha particle is the solid-state nuclear detector (SSNTD) which uses to detect radon with its progeny. The CR-39 is a particular kind of this technique which has several beneficial properties such as fastness against different environmental agents, good sensitivity, and high optical fineness so it applied in a large number of researches[6]. Radon decays by alpha in a half-life of 3.8 days. Since it has short life, uses for examining biological samples examine, like urine, blood, and serum[7]. The best samples to use for identifying excessive uranium taken are considered to be urine samples. It can detect radiation regardless of its concentration and can also predict a person's likelihood of exposure to radiation based on factors like their age, gender, and where they live. Urine analysis can determine the levels of radon products in the human body[8]. Radon cannot be detected in human tissue by relying on routine medical methods as there is no testing technology available to measure it[9]. This may be accomplished by using an appropriate alpha detector, such as the CR-39. The samples of Blood and urine are the most used in environmental pollution[10]. Plastic detector (CR-39) was utilized in the current work for measuring the risk of alpha concentration in freshly excreted urine. This work involves numerous tools employed, where the urine samples have collecting from females who lived in different locations in Baghdad city, suffered from different types of U.T.I (Urinary tract infections). Hassan *et al*., The level of alpha particles emitted by ^{222}Rn, ^{226}Ra, and ^{238}U was measured in blood samples from 10 cancer patients using a solid-state nuclear track detector. The samples were collected from hospitals in Iraq's Karbala Governorate [11]. Furthermore, there are other studies were done on urine samples to calculate the concentration of uranium from the work of Abed *et al*. studied[11] the concentration of uranium concentration in blood and urine samples of renal failure patients in Al-Muthanna city, his study showed that the average concentration of uranium is 0.603ppm and 2.6 µg/l respectively. Usually, urine is checked to evaluate the degree of exposure of persons to normal radiation and to assess the degree of radionuclides when the radioactive background is high, so this type of examination is an important part of the epidemiological survey[12-14].

The goal of the present study is to determine the concentration of alpha particles of Uranium in female patients who suffered from U.T.I (Urinary tract infections). The samples of the study will be taken from the emergency lab in Al-Kindy hospital, and alpha tracks will be determined by using the nuclear track detector CR-39.

Materials and Methods

Research tools

Urine

The urinary system is containing a pair of kidneys, ureters, a bladder, and urethra. All these together precede the urinary system’s work of setting the compilation and volume of body liquids, abstracting waste produces from the blood, and separating the waste and surplus water from the body in the shape of urine. The density of urine range from1.003 to1.035gcm^{-3}, therefore, if there is radiation in the blood, it flows via the kidneys, so the urine carries the radiation next to the filtration process[11]. Urine has 95% water and 5% waste results. The Nitrogenous wastes that are expelled in urine have creatinine, urea, uric acid, and ammonia, as well as ions such as potassium, sodium, and calcium hydrogen is excreted too. Normally urine is yellow colour, though it relies on diet and urine concentration. The scent of urine may give specifics about the health of as personage. Generally, the pH urine is in the range of 4.60-8.00, and an average of 6.00.

CR-39

CR-39 is a solid-state track detector with a thickness 250 µm. This detector's sheet was cut into small pieces (1cm^2 areas each). It is encased in plastic on both sides, and this plastic is removed when it is used to protect it from radiological background[2]. Because of its sensitivity, such a

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detector can detect alphas tracks at low energy levels[15].

The tub method (PVC)

A plastic cylinder called a PVC tube has a thickness of 2.0 mm, 10.5 cm long and 2.1 cm diameter which is made from poly vinyl chloride. In this work it has been utilized to detect the concentration of alpha in the urine samples.

Research Methodology

Samples collection

Urine samples had been gathered from people who lived in Baghdad city. The sample consisted of 30 female who suffered from U.T.I (Urinary tract infections) and 20 healthy female. The age of suffering female ranges between 7-60 years old and the healthy ranged from 8-63 years. The samples were taken from an emergency lab in Al-Kindy hospital as shown in table 1 and 2 with other information about the type of infection of U.T.I in their urine shown in a microscope (Nikon model, 40x/0.65, made in Japan).

- **Samples preparation**

CR-39 detectors were directly immersed in PVC tubes that contain a sufficient amount of urine samples and were stored at room temperature for 30 days (natural exposure). The goal of this storage was to achieve an equilibrium condition for the radionuclides that are in samples. After the exposure period was completed, all detectors were etched in a (6.25 N) NaOH solution at 60oC for five hours. These detectors were then washed in distilled water, dried and put in front of the lens of the optical microscope to enlarge the size of latent alpha particle tracks from radon decay.

- **Curve of calibration**

A reference urine sample with different uranium contents was developed to calibrate our samples under investigation. The uranium concentration of a typical urine sample was changed. Using Eq.1 and known amounts of various volumes of normal uranium combined with urine samples. The detectors CR-39 were then placed in standard urine samples for three weeks. Following that, the detectors were chemically etched and then examined under a microscope to assess the density of the tracks[16].

$$V1 \times C1 = V2 \times C2 \quad \text{……..1}$$

where:

V1: Urine standard sample volume (l).C1: Concentration of uranium in a standard sample (ppm).

V2: Unknown urine sample volume (l).C2: Uranium content in a freshly produced urine sample (ppm).

Using the following relation, the samples' alpha track density (ρ) was calculated.

The density of track (ρ) = The average all tracks/ Field view area..…….... 2

Figure 1 displays the calibration curve for uranium standard samples and track density. The concentration of alpha in the urine samples was determined by comparing the tracks densities that were recorded on the detectors to the standard samples by the Eqs.[11]:

C_X (of the sample)/ρ_X(of the sample)=C_S (standard value)/ ρ_S(standard value) …….3

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

where:

C_X: Concentration of Uranium for the unknown urine sample in (ppm). C_S: Concentration of Uranium in a standard urine sample in (ppm). ρ_X: Track density of unidentified sample (tracks/mm^2).

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

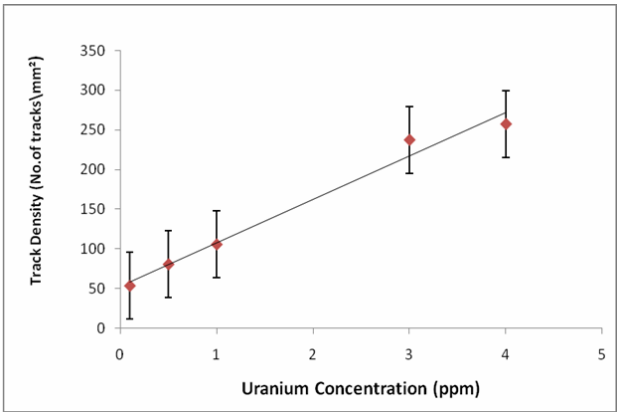

Figure 1. The relationship between the concentration of uranium and through track density for normal urine samples.

Results and Discussion

The main approach for measuring alpha particles released into the body of the human by radon decay and offspring is a urine test. It's a useful approach for determining the natural

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amounts of alpha in urine samples. Table 1 shows the result of alpha particle concentrations in female urine samples who suffered from U.T.I with a type of their infection, occupation and age. These concentrations range from (0.327 -1.583) ppm, with an average of 0.94965 ppm. The maximum value 1.583 ppm is belonging to female with age 57 years, suffering from Urinary casts which are higher than that recorded for females 60 years old, after searching we found that female who records a higher value suffered from other diseases which as diabetes and Thyroid diseases, this means she takes medicine to treat these diseases so this may be the reason for the increase in the percentage result. Table .2, shows the results of healthy female concentration which ranged from (0.022-0.459) ppm with an average of 0.30855ppm. The maximum value belongs to female with age of 43years while the minimum value belongs to female with age of 33years. The comparison between this study of sick people and other healthy which are shown in table 2. It is found that the average concentration of alpha particles for patient's female is higher than healthy. This may indicate the presence of radiation contamination in the area to which patients return. Also, this work involves comparing the results with age categories, Table .3, shows this relationship where the participants were divided into four group, (7-25), (31-39), (40-49) and (50-63), from Table. 1, it clear that the concentration increased as the age increased. Also Fig.2 shows the results of concentration with ages for both (patients and healthy) were increase as age increase. All results vary from female to other depending on age, the geological formation of the area being lived, healthy status of the selected females and the exposure period. The bulk of health hazards has been linked to the accumulation of alpha particles in the body. As a result, it is imperative that the environment be kept as secure and safe as possible. On the contrary, uranium's great availability in some locations poses a risk to public health.

Table 1.Concentration of alpha emitters in fresh urine for female who suffering from different types of U.T.I

N.S	Code	Age years	Occupation	Type infection of U.T.I	Concentration of alpha emitters (ppm)
1	S1	7	student	Pus cell	0.327
2	S2	8	student	Crystal	0.372
3	S3	18	student	Crystal	0.379
4	S4	19	student	Calcium oxalate	0.397
5	S5	20	student	Fungi seen	0.449
6	S6	21	student	Calcium oxalate	0.55
7	S7	25	student	Crystal	0.601
8	S8	31	student	Urine Acid+	0.616
9	S9	32	Housewife	Crystal	0.688
10	S10	33	Housewife	Calcium oxalate	0.841
11	S11	34	employee	Red Blood cells	0.897
12	S12	35	employee	Epithelial cells	0.92
13	S13	36	Housewife	Epithelial cells	0.964
14	S14	37	employee	Pus cell++	0.994
15	S15	38	employee	Crystal	1
16	S16	39	Housewife	Pus cell	1.009
17	S17	40	Housewife	Urinary casts	1.229
18	S18	41	employee	Crystal	1.079
19	S19	42	employee	Pus cell	1.099
20	S20	44	employee	Bacteria seen	1.145
21	S21	45	employee	Pus cell	1.101
22	S22	46	employee	Urine Acid++	1.166
23	S23	47	employee	Red Blood cells	1.189
24	S24	48	employee	Crystal	1.1977
25	S25	49	employee	Urinary casts	1.249
26	S26	50	employee	Crystal	1.282
27	S27	52	Housewife	Pus cell++	1.346
28	S28	55	Housewife	Crystal	1.394
29	S29	57	Housewife	Urinary casts	1.583

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30	S30	60	Housewife	Pus cell+++	1.426
Min					0.327
Max					1.583
Average					0.949657

Table 2. Concentration of alpha emitters in Female urine of reference healthy people

N.S	Code	Age years	Occupation	Concentration of alpha emitters (ppm)
31	S31	8	student	0.022
32	S32	9	student	0.145
33	S33	14	student	0.152
34	S34	17	Student	0.185
35	S35	19	student	0.221
36	S36	20	Housewife	0.267
37	S37	22	employee	0.278
38	S38	32	Employee	0.291
39	S39	37	student	0.308
40	S40	39	student	0.329
41	S41	42	employee	0.337
42	S42	44	employee	0.345
43	S43	46	Housewife	0.367
44	S44	47	employee	0.379
45	S45	48	employee	0.391
46	S46	49	Housewife	0.4
47	S47	53	Housewife	0.401
48	S48	54	Housewife	0.439
49	S49	60	Housewife	0.455
50	S50	63	Housewife	0.459
		Min		0.022
		Max		0.459
		Average		0.30855

Table 3. Alpha concentration average in urine samples as a related to age

Classification	Age range	Full number	Average concentration
Patients group	7- 25	7	0.439286
	31- 39	9	0.881
	40- 49	9	1.161633
	50-60	5	1.4062
Healthies group	8-22	7	0.181429
	32-39	3	0.309333
	42-49	6	0.369833
	53-63	4	0.4385

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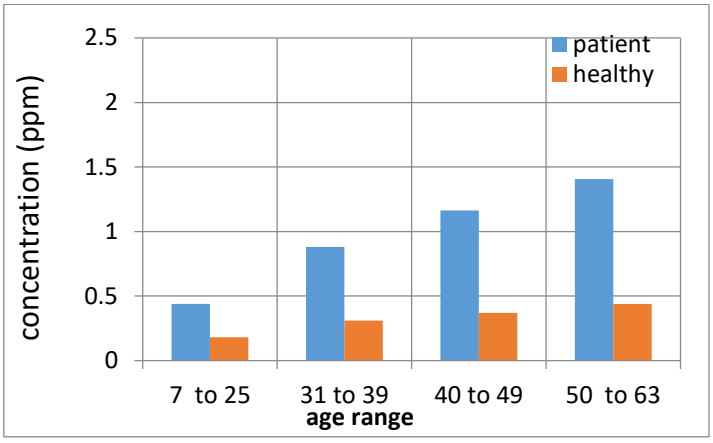

Figure 2. Average concentration of alpha particles in urine samples of both groups of patients and healthy as a function of age

Conclusion

This study revealed that alpha emitter concentrations are different from one woman to another woman, depending on the degree to which women's bodies were allergic to the radiation, their age, and other characteristics. There are low levels of alpha emitters in the researched places and high levels of alpha emitters in the examined areas; it was discovered that the concentration of alpha emitters in urine samples from diverse locations and ages rises with age.

Author's Declaration

- Conflicts of Interest: None.
- /We hereby confirm that all the Figures and Tables in the manuscript are ours. Furthermore, any Figures and images, that are not ours, have been included with the necessary permission for re-publication, which is attached to the manuscript.
- Authors sign on ethical consideration's approval.
- Ethical Clearance: The project was approved by the local ethical committee in Al-Mustaqbal University College.
- Ethics Approval: The Human Ethical Committee of Al-Kindi hospital in Baghdad, Iraq has approved this study with protocol number (protocol 7/2022). Each participant was given written information about the goal of the study prior to the study start, and their written informed consent was obtained

Author's Contribution Statement

The authorship of the title above certifies that they have participated in different roles as follows: N. A. M.; Collect of samples and perform experimental procedure, S. M. O.; Collected the references and literature survey and Writing introduction section and plotting graphs, Sh. A. A.; Contributed in result and discussion section and references, and A. A. H., Contribute in results and discussion and references according to journal author guidelines.

References

1. Valkovic V. Radioactivity in the environment: physicochemical aspects and applications. Elsevier; 2019. pp.12 Copyright: © Elsevier Science 2019. https://www.elsevier.com/books/radioactivity-in-the-environment/valkovic/978-0-444-64146-5.
2. Carante MP, Ballarini F. Radiation Damage in Biomolecules and Cells . Int J Mol Sci. 2020; 21(21): 8188-3. https://doi.org/10.3390%2Fijms21218188.
3. Salih NA, AL-Bakhat YM, Abd ulmajeed Al-Rahmani A, Murbat OM, Ameen NH, Majed NA. Assessment of Radiological Air Contamination for Selected Places at Al-Tuwaitha Nuclear Site during Winter and Spring. Baghdad Sci J. 2018; 15(3). 278-

286. https://doi.org/10.21123/bsj.2018.15.3.0278.
4. Mohammed RS, Ahmed RS, Jawad AI. Measurement of the radon concentration and annual effective dose in Malva sylvestris (Khabbaz) plant used in traditional medicine and food. Baghdad Sci J. 2020; 17(1): 112-115. https://doi.org/10.21123/bsj.2020.17.1.0112.
5. Barba-Lobo A, Gázquez MJ, Bolívar JP. A Practical Procedure to Determine Natural Radionuclides in Solid Materials from Mining. Minerals. 2022; 12(5): 611-13. https://doi.org/10.3390/min12050611.
6. Takahashi LC, de Oliveira Santos T, Pinheiro RM, Passos RG, Rocha Z. Radon dosimetry using Solid State Nuclear Track Detectors in different environments: a review. Appl Radiat Isot 2022; 186: 110217. https://doi.org/10.1016/j.apradiso.2022.110217.
7. Rahman ZQ, Al-Hamzawi AA. Experimental investigation of uranium content in urine samples of cancer patients in Al-Diwaniyah Governorate, Iraq. J Phys Conf Ser. 2020; 1591(1): 012015-8. https://doi.org/10.1088/1742-6596/1591/1/012015.
8. Orosun MM, Ajibola TB, Akinyose FC, Osanyinlusi O, Afolayan OD, Mahmud MO. Assessment of ambient gamma radiation dose and annual effective dose associated with radon in drinking water from gold and lead mining area of Moro, North-Central Nigeria. J Radioanal Nucl Chem 2021; 328(1): 129-36. https://doi.org/10.1007/s10967-021-07644-9.
9. Tsivou M, Livadara D, Georgakopoulos DG, Koupparis MA, Atta-Politou J, Georgakopoulos CG. Stabilization of human urine doping control samples: II. Microbial degradation of steroids. Anal Bio chem. 2009; 388(1): 146-54. https://doi.org/10.1016/j.ab.2009.02.013.
10. Gil F, Hernández AF, Márquez C, Femia P, Olmedo P, López-Guarnido O, Pla A. Biomonitorization of cadmium, chromium, manganese, nickel and lead in whole blood, urine, axillary hair and saliva in an occupationally exposed population. Sci Total Environ. 2011; 409(6): 1172-80. https://doi.org/10.1016/j.scitotenv.2010.11.033.
11. Abed MM, Mahdi KH, Al-Hamadany WS. Estimation of uranium concentration in blood samples of kidneys failure patients in Al-Muthanna governorate. AIP Conf Proc. 2019; 2123(1): 020057-5. https://doi.org/10.1063/1.5116984.
12. Mohsen AA, Abojassim AA. Determination of alpha particles levels in blood samples of cancer patients at Karbala Governorate, Iraq. Iran J Med Phys. 2019; 16(1): 41-7. https://doi.org/10.22038/ijmp.2018.32376.1383. .
13. Adel MM, Tawfiq NF. Uranium Concentrations in Urine of Maternal Samples in Baghdad Governorate. IOP Conf. Ser: Mater Sci Eng. 2020; 928(7): 072121-8. https://doi.org/10.1088/1757-899X/928/7/072121.
14. Abbas SK, Hussain HS, Saleh DS. Estimation of Uranium Concentration in Urine Samples of Three Age Groups of Healthy Individuals in Najaf Governorate Using CR-39 and LR-115 Solid State Detectors. Iraqi J Sci. 2022: 3359-3365. https://doi.org/10.24996/ijs.2022.63.8.11.
15. Rahman ZQ, Al-Hamzawi AA. Experimental investigation of uranium content in urine samples of cancer patients in Al-Diwaniyah Governorate, Iraq. J Phys: Conf Ser 2020; 1591(1): 012015-8. https://doi.org/10.1088/1742-6596/1591/1/012015.
16. Obed RI, Ademola AK, Ogundare FO. Radon measurements by nuclear track detectors in dwellings in Oke-Ogun area, South-Western, Nigeria. Radiat Prot Dosim. 2012; 148(4): 475-81. https://doi.org/10.1093/rpd/ncr196.

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فحص أثار ألفا لعينات البول للأناث اللاتي يعانن من التهابات المسالك البولية

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الخلاصة

تم جمع عينات بول من اناث مقيمات في مدينة بغداد. تكونت العينة من 30 أنثى مصابة بالتهابات المسالك البولية U.T.I و 20 أنثى بصحة جيدة . تم تحديد نوع التهاب المسالك البولية بواسطة مختبر الطوارئ في مستشفى الكندي ، وتم تحديد آثار ألفا بواسطة كاشف الأثر النووي CR-39. تراوحت تركيزات ألفا في 30 عينة بول مأخوذة من إناث مصابات بعدوى في المسالك البولية من 0.327 جزء في المليون إلى 1.583 جزء في المليون ، بمتوسط 0.94965 جزء في المليون. تعود القيمة القصوى 1.583 جزء في المليون إلى أنثى تبلغ من العمر 57 عامًا. تراوحت نتائج تركيز الإناث الأصحاء بين 0.022 جزء في المليون - 0.459 جزء في المليون بمتوسط (0.30855 جزء في المليون). كشفت النتائج أن تركيزات باعث ألفا تختلف من امرأة إلى أخرى ، اعتمادًا على درجة حساسية أجسام النساء للإشعاع ، وفقًا لأعمارهن. كشفت النتائج أن الأنثى المريضة لديها تركيزات أعلى من الإناث الأصحاء.

الكلمات المفتاحية: آثار ألفا ، كاشف الأثر النووي CR-39 ، التعرض للإشعاع ، التهابات المسالك البولية، عينات الادرار.