Relation between Renal Investigated Parameters with respect to Uranium Concentration for Cancer Patients

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Abstract— the measurement of uranium concentration in urine very important for many reasons, specially, for human health, where is initial index to the presence of cancer in the human body. The uranium concentration in urine measured by using KPA (kinetic phosphorescence analysis) which consider fast and accurate method to measure uranium concentration with detected limits about (10 ng/L), after that the samples were prepared to measurement. In this study, (101) samples of urine, (71) from patients with different type of cancer, (30) from healthy people were collected by taking into account the age, gender, educate, type of water, cancer history for patients. etc. Then, general urine have been analyzed before prepare the samples to measure uranium concentration in urine by KPA. The obtained results demonstrated that the uranium concentration for all healthy people about (1 µg/L) while for healthy ranging from (0.59-3.9 µg/L), therefore, and in general, the uranium concentration for patients higher than healthy people. Moreover, the results showed that the uranium concentration increases with increasing age and with and varied with cancer history for patients. Besides, the uranium concentration for patients who are drinking R.O water higher than the patients whose drinking piped water. Finally, the results illustrated that the RBC and amorphous crystals increase with increasing uranium concentration.

Key words: KPA, ^{238}U, cancer, urine

1 INTRODUCTION

The element Uranium is the basis of and parent of almost all releases of radioactivity to the environment, yet curiously, until it began to be employed as a weapon, it had been quite neglected as a hazardous component. The intense and increasing interest in the health of the troops who participated in the first Persian Gulf War in Iraq, and later those who served in the Balkans, where Uranium weapons were also used, and of course the civilian populations of those areas have resulted in evidence that the genotoxicity of Uranium is far greater than the military who used it, and the states which sanctioned this, believed. Despite the increasing evidence of its anomalous propensity for harm, from epidemiology and from laboratory and theory, the ICRP risk model, here as in everywhere else in radiation protection, is used to deny the evidence and to sanction its continued use as a weapon of war. As with the fallout from bomb tests, Chernobyl and the child leukemia near power stations, clear evidence of harm from exposure to Uranium is denied on the basis of deductive logic, that the absorbed doses are too low to cause any measurable effect **[1].**

For 15 years, the debate about depleted uranium (DU) and its detrimental effects on the health of veterans of the Gulf War of 1991, on the Iraqi people and military (and subsequently on the people of Kosovo, Afghanistan, and Iraq during the second war) has remained unresolved. Meanwhile, the number of Gulf War veterans who have developed the so-called Gulf War syndrome has risen to about one-third of the 800,000 U.S. forces deployed, and unknown proportions of those involved in the subsequent wars. Uncounted civilians and personnel of other nations that fought in Iraq and other wars since 1991 have also been afflicted. The veterans have suffered from multiple serious physiological disorders and have received little or no official recognition, medical relief, or compensation **[2].** Uranium excretion in urine is proportional to the uranium level in the body. This is why renal uranium excretion is used in this study to detect incorporated uranium. Measurements of uranium excretion in urine, in contrast to feces, provide a reliable basis for detection uranium. The report submitted by Iraqi ministry of health in 2008 proved that the incidence rate of cancer after Gulf Wars increased dramatically after several years (which have been used depleted uranium in Gulf Wars) **[3].** However, several international and national works were achieved. In 1979 M. Afzal and A. Aziz described the importance of urine analysis for determination of internal contamination of a worker for uranium and outline the objective and scope of urine analysis **[4].** It also discussed briefly the metabolism of uranium in order to establish an empirical relationship between its excretion and body burden. Finally, they discussed the results of uranium bioassay studies for radiation workers in the Nuclear Materials Division. J. Bogard use Bioassay Techniques in 1996 and said that, a variety

of analytical techniques is available for evaluating uranium in excreta and tissues at levels appropriate for occupational exposure control and evaluation **[5].** A few (fluorometry, kinetic phosphorescence analysis, a-particle spectrometry, neutron irradiation techniques, and inductively-coupled plasma mass spectrometry) have also been demonstrated as capable of determining uranium in these materials at levels comparable to those which occur naturally. Sample preparation requirements and isotopic sensitivities vary widely among these techniques and should be considered carefully when choosing a method. This report discusses analytical techniques used for evaluating uranium in biological matrices (primarily urine) and limits of detection reported in the literature. In 2011 X. Dai said that the measurement of Urine concentration is the best method for measure and monitoring accidental or chronic internal intake of uranium into the human body **[6].** Anew radiochemical separation procedure has been developed to provide isotopic uranium analysis in urine samples.

2 Methodology

In this study, 101 samples have been collected from people life in Wasit governorate. 30 samples from healthy people (male and female) and 71 samples from cancer patients who toke treatment in Al-Kut hospital. General urine analysis for all samples were made and information from patient and healthy people was registered such as gender, age, degree of education, etc. Then uranium concentrations have been measured by kinetic phosphorescence analysis (KPA-11) in Iraqi Radiation Protection Center. KPA-11 uses pulsed laser excitation and gated detection for the determination of Uranium concentration **[7].** KPA-11 needs proper preparation of urine samples because unprocessed urine cannot be analyzed without pretreatment except at levels well above 20 mg/L. Resulted uranium concentration values have been drawn as a function of parameters (general urine and information) in order to know if high uranium concentration is one of the very important causes of cancer. Patients have been denoted by (P), while healthy have been denoted by (H). On the other hands, the black curves denoted to patients, while red color curves denoted to healthy case.

However, the recipe for preparing and sampling the urine samples of refs **[8, 9]** was used, as follow:

1- A 5 mL of sample must be pipited into a glass vial previously was treated.
2- A 1 mL of concentrated HNO_3 should be added and two or three drops of 30% hydrogen peroxide.
3- The vial must be placed on a hot plate and heat to dryness. Care must be taken that spattering of the sample does not occur, placing the vial in a 50 mL beaker makes it easier to handle and not so apt to be knocked over.
4- The vials would be removed from the hot plate and we add 1 mL of concentrated HNO_3, two or three drops of 30% hydrogen peroxide, and we heat to dryness. We repeat as necessary until only a white or translucent residue remains.
5- A 1 mL of 4 M HNO_3 must be added and warmed gently, if necessary, to dissolve the residue. Then add 4 mL of water, and swirl to mix thoroughly.
6- Finally, solution has been analyzed using KPA-11.

3 Results and Disscussion

A- Gender

The vast majority of cancer types have a higher incidence rate in males relative to females, with one of the few and obvious exceptions to the rule being breast cancer **[10].** The reasons why males seem to be so much more prone to developing cancer than females are complex and still only partially understood **[11].** There may be a biological component, with women's sex hormones and immune system being implicated in some of the differences seen, though these have not been fully explored **[12].** There may also be factors related to ethnicity and family history of cancer, which increase susceptibility to certain cancers **[13].** In this study it is noted that the concentration of uranium for cancer patient higher than healthy and the number of female that incidence in cancer more than male because the breast cancer. The most frequently between type of cancer so that we will be calculate (incidence probability) to prove that male most incidence in cancer. The uranium concentration was very closely for male and female for healthy and patients. This is shown in **table (1).**

Table (1): average of uranium concentration and the Gender for healthy and patients.

case	Gender	itertion	Average of UC(µg/L)
H	male	7	1.016
H	female	23	1.021
P	male	14	1.606
P	female	57	1.59

B- Cancer History

When we look at cancer history or (family history), we look at the number of relative who have had cancer, and their ages when they developed it. Cancer occurring at older ages is less likely to be inherited. The types of cancer relatives have had is also important as only certain types of cancer are related to each other .many cancer types ,such as lung cancer and cervical cancer are usually due to environmental than genetic effects **[14].** In this study, uranium concentration for patient with family history about (1.76 µg/L) and whose numbers (10) higher than those without family history whose number 61 with uranium concentration (1.076 µg/L). Most patients in this study without family history for cancer, as shown in **figure (1).**

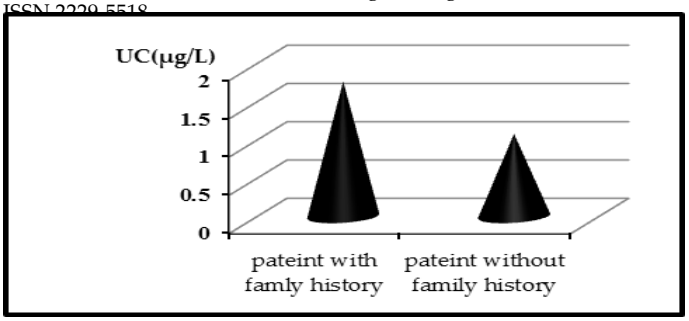

Fig. (1): average of uranium concentration as a function to the cancer history with cancer for patients.

C- Age

Cancer, we have come to learn, is principally a disease of aging. Its likelihood increases, as we get older, in part because cancer does not occur at a precise moment in time, but rather is a process, which can take many years to develop **[15].** Cancer is predominantly a disease of age. Half of people newly diagnosed with cancer in the UK are aged over 70 **[16].** From **table (3)** divided the age to categories from healthy and patients. Noticed that for healthy UC Almost constant where the average of it was (1.01µg/L). For patients frequently increase for patient with Categories (30-39), (40-49). UC for patients with Categories (30-39) higher than another categories, Followed by categories (20-29), and (40-49). That is proving that UC and The risk of cancer increase with increasing age, this was show in table (2) and **figure (2)**.

Table (2): average of uranium concentration and the age period for healthy and patients.

Age priod	Iteration of age of healthy	Average of UC(µg/L)of healthy	Itertion of age ptients	Average of UC(µg/L)of patients
0-19	2	1.032	2	1.361
20-29	13	1.0186	5	2.015
30-39	7	1.0101	8	2.14
40-49	3	1	24	1.62
50-59	3	1.02	17	1.47
60-69	2	1	13	1.38
70-79	0	0	2	1.12
The total case	30	1.0133	71	1.586

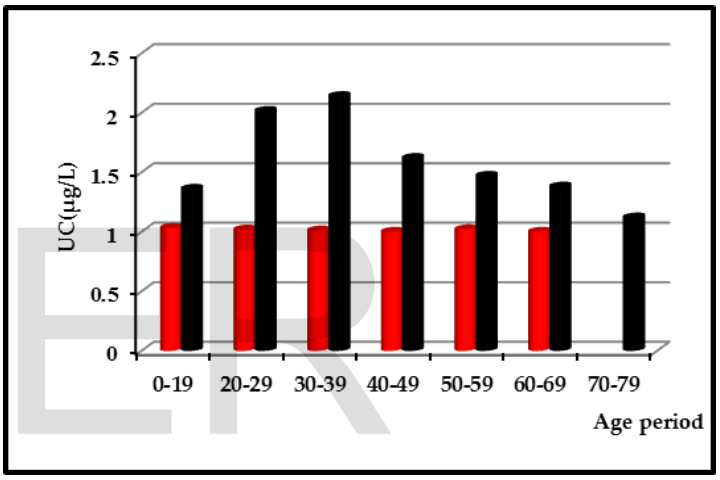

Fig. (2): average of uranium concentration as a function for age period.

D- Education

It is an acceptable proxy for thinness and fatness, and has been directly related to health risks and death rates in many populations **[17].** They have a preventive action on both gastric cancer caused by Helicobacter Pilory and hepatocarcinoma caused by hepatitis B and C **[18].** Also daily sports, stay away from radiation source and its causes, quit smoking, eating food rich in fiber and mineral, ventilation close place, and live away from place that contaminated by radiation. It has to do with reducing UC and therefore, reducing incidence in cancer. All this factors, it follows the consciousness of man and they are perceptible. So that, we take into consideration degree of education when we done this study. Where it is supposed UC reducing in education people, but one can be). observed that UC very closely for healthy (1.01 µg/L) for educated and uneducated, as well as the patient where UC for educated (1.64 µg/L) whose iteration (37), while for uneducated UC (1.53 µg/L) and they are iteration (34) as shown in fiure (3).

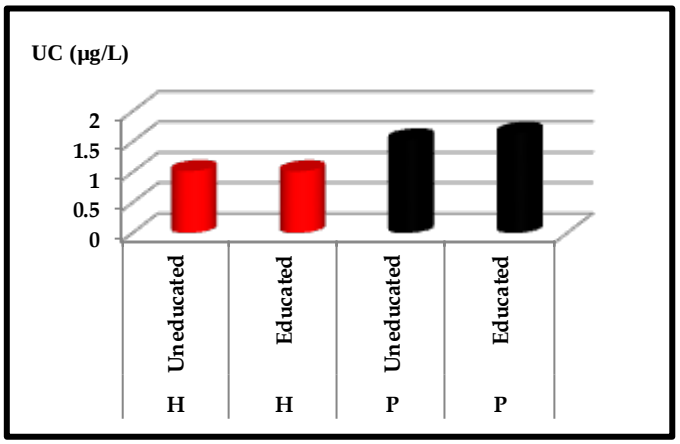

Fig (3): average of uranium concentration and degree of education for healthy and patients.

E- Cancer Type

Male get cancer more than female as we noted earlier, but because that the large number of women in this study get breast cancer, where breast cancer more frequently in this study in (44) patients from female, with UC (1.58 µg/L) followed by bladder and ovary cancer with UC (1.65 µg/L) and (1.51 µg/L) respectively.

The extremely dense particles only change the deposition/retention in the lung by (10%) or less, so that the maximum UC in the patient with lung cancer, where the value (3.289 µg/L) in one patient, and patient with Thyroid cancer with UC (2.2 µg/L), another type of cancer showed in table (3). This results illustrated in figure (4). From figure (4) we noted that UC for patient with blood cancer very closely to the normal rate of uranium concentration in healthy body, because the blood consider the main carrier to food and oxygen in human body, through its moving in body Emptying all its contents Including uranium so that concentration of uranium very low in blood.

Table (3): average of uranium concentration and cancer type.

Cancer type	iteration	Average of UC(µg/L)
Breast	44	1.58
colon	3	1.59
Pancreas	1	1.21
brain	3	1.35
prostate	1	1.244
Thyroid	2	2.2
bladder	4	1.65
blood	1	1.051
throat	2	1.47
liver	1	2.041
ovary	4	1.51
lung	1	3.289
Testicular	1	1.299
lymphoma	1	1.96
Common cancer	2	1.34
The total	71	1.65

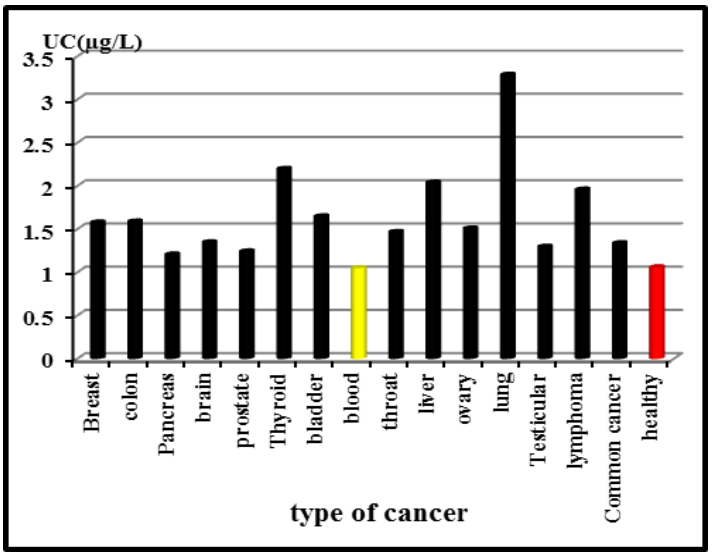

Fig (4): average of uranium concentration as a function type of cancer.

F- Color of urine

From **table (4),** all of patients they are color yellow which its normal color for urine, while the healthy people, (19) of them they are urine color yellow, and (11) of them they are urine turbid, while UC very closely for all healthy (about 1 µg/L) which its lower than UC for patients (1.59 µg/L). It is noted that most of healthy persons with turbid urine they are epithelial cell ranging from (3-4 +) while for healthy with yellow urine ranging from (0-2 +), another reason for turbidity for healthy color urine is increase pus cells or red blood cells in urine of healthy. For patients most of them epithelial cell ranging from (0-2 +), this is may be the reason of increase turbid urine in healthy more than patients. In addition, there is no relation between UC and colors of urine.

Table (4): average of uranium concentration and color of urine for healthy and patients.

case	Color of urine	iteration	UC(µg/L)
H	yellow	19	1.012
H	turbid	11	1.021
P	yellow	71	1.59

G- Red Blood Cell (RBC)

From **table (5),** and for healthy persons, (24) of them they are urine didn't contain, and (5) of them have RBC ranging from (0.5) to (4.5), the last one rate of RBC was (7) and the UC for all them about (1 µg/L). While for patients, only (13) of them have zero RBC, and all others they are urine contain RBC ranging from (0.5-5) and the highest UC (2.64 µg/L) for patient with RBC (5) for one of patients followed by UC (2.35 µg/L)

for patient with RBC (2). In general, one can note that RBC increases in urine of cancer patients more than RBC in urine of healthy persons because the blood consider the main transporter in human body which transfer the oxygen from lung to all body as well as transfer the food from digestive to all body cells and transfer the craps to Kidneys to extract it out the body. Through this process transfer the uranium which ingested by blood to the kidneys which extract it with urine of patient. Therefore, UC in cancer patients highest than the healthy persons. RBC increases in patients because that most of patients have amorphous crystals in their urine causing infections of the urinary tract appearance as RBC in the urine.

Table (5): average of uranium concentration and number of red blood cell in urine of healthy and patients.

RBC	Iteration of H	Average of UC(µg/L)of H	Iteration of P	Average of UC(µg/L)of P
0	24	1.017	13	1.19
0.5	1	0.998	33	1.7
1	0	0	2	1.5
1.5	1	1.019	9	1.5
2	0	0	1	2.358
2.5	1	0.999	7	1.48
3	1	1.012	1	1.146
3.5	0	0	3	1.74
4	0	0	0	0
4.5	1	0.999	1	1.047
5	0	0	1	2.649
5.5	0	0	0	0
6	0	0	0	0
6.5	0	0	0	0
7	1	1.017	0	0
The total	30	1	71	1.63

H- Pus cell

From table (6), one can note that all healthy people have pus cell in their urine ranging from (0.5-6 +) with constant uranium concentration for all patients about (1 µg/L). For patients, (11) of them did not have pus cell, other patients they are pus cell ranging from (0.5-5 +) and one of them have (7 +) of pus cell. Most of patients have few number of pus cell ranging from (0.5-1.5 +), while most of healthy they are pus cell ranging from (1.5-6 +). It is expected that persons with pus cell did not have cancer cells and this mean the pus cells (White blood cells) it done defensive role against cancer cells to limit their effectiveness. However, there is no relation between pus cells and uranium concentration in urine.

Table (6): average of uranium concentration and pus cell in urine of healthy and patients.

Pus cell(+)	Iteration of H	Average of UC(µg/L)of H	Iteration of P	Average of UC(µg/L)of P
0	0	0	11	1.368
0.5	3	1.02	23	1.62
1	5	1.01	6	1.55
1.5	2	0.997	16	1.65
2	7	1.025	1	1.302
2.5	4	1.022	10	1.28
3	2	1.038	0	0
3.5	1	0.995	0	0
4	1	0.997	0	0
4.5	1	1.0223	1	1.299
5	2	1.01	2	2.61
5.5	1	1.017	0	0
6	1	1.018	0	0
6.5	0	0	0	0
7	0	0	1	2.217
The total	30	1.014	71	1.655

I- Epithelial cell

Epithelial cell was found in urine of male and female with normal concentration, but large quantity refers to problem in kidney or bladder or in Urinary Tract, and some time refers to the presence of cancerous tumors. In this study, as showed in **table (7)**, one can note that epithelial cell in healthy persons more than the patients, with average of uranium concentration for healthy about (1 µg/L), while for patients (1.66 µg/L).

Table (7): average of uranium concentration and epithelial cell for healthy and patients.

epithelial cell(+)	Iteration of H	Average of UC(µg/L)of H	Iteration of P	Average of UC(µg/L)of P
0	8	1.02	51	1.55
0.5	0	0	6	1.377
1	6	1	5	1.83
1.5	0	0	1	1.58
2	7	1	3	2
2.5	0	0	1	1.344
3	6	1.025	1	1.689
3.5	0	0	2	2.03
4	3	1.024	0	0
4.5	0	0	1	1.614
The total	30	1.013	71	1.66

From the above table, the higher average of uranium concentration about (2µg/L) for patient with epithelial cell (3.5 +) while the lowest average of uranium concentration (1.344 µg/L) for patient with epithelial cell (2.5 +), while for healthy persons the average of uranium concentration about (1µg/L). This refers to that the epithelial cells independent on uranium concentration.

J- Amorphous crystal

According to obtained results, one can note that not all healthy persons had amorphous crystal in their urine and the average of uranium concentration about (1.016 µg/L). While (53) of patients have Amorphous crystals in their urine, where the highest uranium concentration was (1.87 µg/L) for patient with (3 +), (1.75 µg/L) for patients with (2 +) and about (1.6 µg/L), so that the Amorphous crystal increase with uranium concentration.

K- Bacteria

From **table (8)** there are (61) of patients did not have bacteria in their urine with uranium concentration (1.55 µg/L), while only (10) of patients have Bacteria of patients with uranium concentration (1.83 µg/L), i.e. uranium concentration increase with increase bacteria in urine of patients.

Table (8): average of uranium concentration and bacteria for patients.

bacteria	Iteration of P	Average of UC(µg/L) of P
0	61	1.55
1	10	1.83
The total	71	1.69

L- Mucous

Mucus in urine can be symptom of intestinal disorders such as irritable bowel syndrome and ulcerative colitis. Mucus is a viscous colloid, yellow in color, which occurs in various organs of the body, including the lungs and the large intestine. The mucus membrane is responsible for mucus production. The mucus protects the inner wall of the intestine and lubricates the passage of stool for easy elimination, but increase of mucous in urine refer to Urinary Tract Infection (UTI), Sexually Transmitted Disease (STD), Irritable Bowel Syndrome (IBS), Ulcerative Colitis, Urachal Cancer, and Kidney Stones. As showed in table (9), (43) of patients did not have mucous in their urine and they had uranium concentration (1.53 µg/L), (27) of patients have few mucous about (1+) with uranium concentration (1.67 µg/L) and only one of them have (2+) with uranium concentration (2.217 µg/L). So that there is no relation between mucous in urine and uranium concentration.

Table (9): average of Uranium concentration and mucous for patients.

mucous	Iteration of P	Average of UC(µg/L)
0	43	1.53
1	27	1.67
2	1	2.217
The total	71	1.59

M- Type of water

Few things tie humans so directly to the natural environment as drinking water. The contamination of water is a direct reflection of the degree of contamination of the environment. After flushing airborne pollutants from the skies, rainwater literally washes over the entire human landscape before running into the aquifers, streams, rivers, and lakes that supply our drinking water. All of the chemicals generated by human activity can find their way into water supplies. Evaluating possible links between drinking water and cancer means identifying those chemicals that appear in enough water supplies at sufficient concentrations to pose a substantial attributable cancer risk. Contaminants may enter water supplies at many points before reaching the tap. The types and quantities of carcinogens present in drinking water at the point of consumption may result from contamination of the source water, arise because of treatment processes, or enter as the water is conveyed to the user. Many different carcinogens may contaminate source waters, but they usually exist in drinking water at low concentrations. On the other hand, chemicals that enter drinking water during the course of water treatment are limited in number, but these chemicals appear in drinking-water supplies with greater frequency than most source water contaminants. Finally, the compounds contained in the pipes, joints, and fixtures of the water distribution system may contaminate treated water on its way to the consumer. Similarities in the construction of drinking water distribution systems mean that any carcinogen entering through this pathway may be widespread and can pose substantial attributable risks of cancer [19]. in this study the average of uranium concentration for healthy was (1.016 µg/L) where all healthy drinking R.O water and for patient whose drinking R.O water UC was (1.667µg/L), while for patients whose drinking piped water (1.346 µg/L). UC for patient higher than healthy, for patients who drinking R.O water UC higher than those who drinking piped water. That is mean that piped water radially better than R.O water because R.O or bottles water have Potassium within components, which associated with uranium series always. Piped water do not have high rate of Potassium element, precipitates in the form of salts then liquidates, while bottles water when its liquidates from Potassium and another salts be added. So that UC for patients that drinking piped, water less than UC for patient whose drinking R.O water.

4 Conclusions

In this study, we arrive to some conclusions that can be taken into consideration:

1. The uranium concentration for the patients high than healthy people, and roughly equal for male and female. The female most cancer than male, because increase breast cancer.

2. The patients with cancer history, have higher uranium concentration in they are urine, where the most of them from female with breast and ovary cancer.

3. The uranium concentration increase with age.

4. Uranium concentration is closely between the people whose educated and uneducated form healthy persons and patients.

5. Females were the most of cancer patients because most of them infected with breast cancer.

6. The patients with blood cancer have the lowest uranium concentration, which nearly equal to uranium concentration in healthy people.

8. There is no relation between the uranium concentration and urine color. Where the color of urine for all patients is yellow which is normal color of urine.

9. UC for patients that drinking piped water less than UC for patient who drinking R.O water.

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