

Estimation Of Cd Heavy Metal Concentrations in Urine Samples of Cancer Patients in Babylon Governorate -Iraq

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Abstract

In the current research, atomic absorption spectrophotometer was used to determine the concentration of cadmium in urine sample of cancer patients and healthy group ,as the highest value of lead concentrations in urine samples is (0.7631 ± 0.043) $\mu\text{g/l}$ male, suffering cancer prostate returns to age of 91 years old from of Khatounia and the minimum concentration of cadmium in urine samples is (0.0107 ± 0.002) $\mu\text{g/l}$, male, suffering cancer prostate returns age 80 years old From Gbalih and the average value of cadmium concentration in samples of urine for this group was found (0.2950 ± 0.015) $\mu\text{g/l}$, the highest of cadmium concentration in urine sample healthy group was (0.2871 ± 0.030) $\mu\text{g/l}$ and lowest value was (0.0029 ± 0.00) $\mu\text{g/l}$ in average value (0.0811 ± 0.05) $\mu\text{g/l}$.The effect was studied by the concentration of cadmium according to age and smoking habit.

Keywords: heavy metals, Cd concentration, urine sample, atomic absorption spectrophotometer.

1. Introduction

The continuous rise in the level pollution due to heavy elements, excessive use of pesticide, industrial wastes disposal, mining activities and other activities that have harmful effects on human health (Milam et al., 2015). Heavy metals are used widely in industries for various production purposes, and living organisms require certain reduced amounts for metabolic activities. On other hand high levels are harmful to living organisms that cause nervous weakness, damage to the lungs and liver, and low energy levels. Cadmium causes the greatest concern (Willscher et al., 2017). Because it is easily transported through food chains and is not known to perform any vital biological function (Ciazela et al., 2018). Human exposure to heavy metals especially in the developing countries has continuously been on the increase. This is due to the increase in the domestic and industrial activities of man. Generally, human beings are exposed to these metals by ingestion, that is; eating and drinking, inhalation through breathing and dermal routes (Ogunfowokan et al., 2008) and (Sabine, M and Wendy, G., 2009). Heavy metals get into the environment through natural and anthropogenic means (human activities). These include natural weathering of the earth's crust, mining, soil erosion, urban runoff, industrial discharge, sewage effluents, application of pesticides on crop, air pollution fallout, and many others (. Ming-Ho Y., 2005).

2. Materials And Method

2.1 Sample collection

In the current study, 100 urine samples were taken from two groups of cancer patients and healthy people. The first group consisted of (50) urine samples collected from Babylon Cancer Center, and the second groups consisted of (50) samples collected from different areas of Babel Governorate. The age range of the patients were from 50-90 years of age, Age of patients and healthy people were also considered. The samples are acidified to prevent polymerization. Tables 1: Sample code and location for healthy group in the current study.

2.2 Experimental Method

Urine samples were digested using the procedure described by (Memon et al., 2007). Urine samples were collected from two groups (patients' group and healthy people) and were collected from the Babylon cancer center. The samples were distinguished by placing special numbers and then they kept in special cool boxes to prevent sample from being damaged and then kept in the refrigerator until the time of investigation. The urine samples were allowed to be thawed thoroughly at room temperature. 4 mL freshly prepared $\text{HNO}_3/\text{H}_2\text{O}_2$ (2:1 v/v) was added to 1 mL of each urine sample and left for 10 min as a pre- digestion time, then placed in a microwave oven. The samples were then heated following a one-stage digestion, programmed at 80% of the total power in a Samsung domestic microwave oven with maximum heating capacity of

950 W for 2-3 min as seen in figure 1

Tables 1: Sample code and location for healthy and patients group in the current study.

Sample code	Location	Sample code	Location	Sample code	Location	Sample code	Location	Sample code	Location
H 1	AL-Hamzia	H 11	Nadier second	H21	AL-Hashmia	H31	Al-Mahwel	H41	AL-Bakerly
H2	AL-Qasim	H12	Al-Gazier	H22	AL-Mahiwel	H32	AL-Hamiza	H42	AL-Gmeiah
H3	AL-Bakerly	H13	AL-Hamiza	H23	Gbilh	H33	AL-Mameeria	H43	AL-Gamieah
H4	AL-Bakerly	H14	Al-Mahiwel	H24	Katoniah	H34	Nader first	H44	AL-Hswa
H5	AL-Mameeria	H15	AL-Mahiwel	H25	Al-Qasim	H35	AL-Kifel	H45	Al-Mhaniwiah
H6	AL-Qasim	H16	Al-Hashimia	H26	AL-Bakerly	H36	AL-Msaib	H46	Babel neighborhood
H7	AL-Madhatiah	H17	Al-Bakerly	H27	Al-Bakely	H37	AL-Hamiza	H47	Abo-Drowend
H8	AL-Niel	H18	Al-Gazire	H28	AL-Mameeria	H38	Abu drowned	H48	Gbalih
H9	AL-Gamiahia	H19	Al-Kafil	H29	Al-Hamiza	H39	AL-Qasim	H49	Sangar
H10	AL-Qasim	H20	Al-Qasim	H30	Al-Mahdiah	H40	Torij	H50	AL- Taliah
Sample code	Location	Sample code	Location	Sample code	Location	Sample code	Location	Sample code	Location
C 1	AL-Tohmazia	C 11	Al-Taleiah	21	Al-Hamzia	H31	The role of fabric	C41	AL-Askan
C2	AL-Musayyab	C12	AL-Mahwil	C22	AL-Hashmiah	C32	Al-Madhatiah	C42	Al- Gamian
C3	AL-Qasim	C13	AL-Qasim	C23	Gbalih	C33	Industrial gastric	C43	AL-Askari
C4	AL-Gaziar	C14	Al-Kifil	C24	AL-Haswah	C34	AL-Kefil	C44	Torij
C5	Jbalih	C15	AL-Niel	C25	AL-Madhatiah	C35	AL-Bakerly	C45	Al- Hamzia
C6	Al-Handiah	C16	AL-Hamzia	C26	Al-Maamira	C36	AL-Mahwile	C46	Officers District
C7	Al-Haswa	C17	AL-Mahiwil	C27	AL-Mahawil	C37	AL-Hamziah	C47	Khatounia
C8	AL-Bakerly	C18	Al-Mahdiah	C28	Torij	C38	Nader first	C48	Khatounia
C9	Sngar	C19	Al-Mahwil	C29	AL-Maamira	C39	AL-Gamiahia	C49	AL- Qasim
C10	AL-Qasim	C20	Al-Dabliah	C30	AL-Katoniah	C40	AL-Bakerly	C50	The role of the fabric

Table 2: cadmium concentration(µg/l) in urine sample of cancer patients.

No	Sample Code	Age	Smoking habit	Cd ± S D	No	Sample Code	Age	Smoking habit	Cd± SD
1	C1	50	S	0.0688±0.022	26	C26	78	S	0.4916±0.021
2	C2	52	S	0.278±0.031	27	C27	78	N	0.1019±0.015
3	C3	53	N	0.4652±0.022	28	C28	80	N	0.0813±0.006
4	C4	55	S	0.6082±0.034	29	C29	80	N	0.1813±0.014
5	C5	55	N	0.2891±0.012	30	C30	82	S	0.5978±0.011
6	C6	56	N	0.4842±0.033	31	C31	83	S	0.0331±0.005
7	C7	57	N	0.1331±0.011	32	C32	84	N	0.1334±0.015
8	C8	57	S	0.3566±0.013	33	C33	85	S	0.0899±0.005
9	C9	58	N	0.2859±0.015	34	C34	85	N	0.4266±0.011
10	C10	59	S	0.2313±0.02	35	C35	86	N	0.3795±0.012
11	C11	60	N	0.1587±0.011	36	C36	87	S	0.7065±0.015
12	C12	62	N	0.1053±0.009	37	C37	88	S	0.3689±0.011
13	C13	63	S	0.6248±0.043	35	C38	89	N	0.2185±0.009
14	C14	66	S	0.5398±0.011	36	C39	90	N	0.2064±0.011
15	C15	66	N	0.295±0.008	37	C40	90	S	0.32±0.013
16	C16	68	S	0.5228±0.021	38	C41	90	S	0.0355±0.003
17	C17	68	N	0.4277±0.011	39	C42	90	N	0.5274±0.012
18	C18	69	N	0.2169±0.015	40	C43	90	S	0.118±0.022
19	C19	70	N	0.0525±0.02	41	C44	91	N	0.1203±0.02
20	C20	70	S	0.3347±0.011	42	C45	91	N	1.0484±0.024
21	C21	72	S	0.2221±0.015	43	C46	91	N	0.5203±0.012
22	C22	73	N	0.3721±0.02	44	47	92	N	0.7631±0.023
23	C23	75	N	0.0107±0.004	48	48	92	S	0.2478±0.013
24	C24	76	S	0.411±0.015	49	C49	93	S	0.2462±0.021
25	C25	77	S	0.038±0.003	50	C50	93	S	0.1837±0.015
Mean ±SD		0.2950±0.015							
Max.		0.7631±0.043							
Min.		0.0107±0.002							

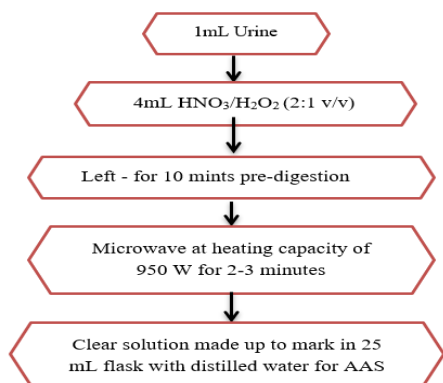


Figure (1): Sample preparation for measuring Cadmium element.

3. Result and Discussion

The table 2: shows the concentration of cadmium in

Table 3 :cadmium concentration (µg/l) in urine sample of healthy groups.

No	Sample Code	Age	Smoking habit	Cd± S D	No	Sample Code	Age	Smoking habit	Cd± SD
1	H1	50	S	0.0203±0.004	26	H26	75	S	0.0928±0.001
2	H2	50	N	0.1218±0.012	27	H27	77	N	0.0029±0.0001
3	H3	51	N	0.0493±0.001	28	H28	79	N	0.0145±0.003
4	H4	52	S	0.2871±0.015	29	H29	80	S	0.0696±0.001
5	H5	52	S	0.8662±0.011	30	H30	80	S	0.0232±0.004
6	H6	52	S	0.0783±0.002	31	H31	82	N	0.0377±0.002
7	H7	54	N	0.0406±0.001	32	H32	82	N	0.1479±0.015
8	H8	56	S	0.0464±0.002	33	H33	84	N	0.0841±0.003
9	H9	58	N	0.0754±0.004	34	H34	84	S	0.0789±0.005
10	H10	58	N	0.0384±0.001	35	H35	85	S	
11	H11	60	N	0.2349±0.011	36	H36	85	N	0.0493±0.001
12	H12	60	S	0.0754±0.005	37	H37	86	S	0.0667±0.002
13	H13	62	N	0.0957±0.002	35	H38	88	N	0.0145±0.001
14	H14	63	S	0.2436±0.03	36	H39	90	S	0.0087±0.0005
15	H15	64	N	0.2378±0.022	37	H40	90	N	
16	H16	65	N	0.0609±0.001	38	H41	90	N	0.0435±0.003
17	H17	66	N	0.0261±0.002	39	H42	91	N	0.0319±0.004
18	H18	69	S	0.0348±0.004	40	H43	91	S	0.0889±0.001
19	H19	71	N	0.0406±0.002	41	H44	91	S	0.0348±0.004
20	H20	71	S	0.0812±0.003	42	H45	92	N	0.4338±0.03
21	H21	72	S	0.1044±0.013	43	H46	92	N	0.5203±0.012
22	H22	72	N	0.0957±0.005	44	H47	93	S	0.1044±0.01
23	H23	72	S	0.0638±0.003	48	H48	93	S	0.0493±0.001
24	H24	74	S	0.0551±0.002	49	H49	94	S	0.0754±0.002
25	H25	75	N	0.0298±0.003	50	H50	94	N	0.0609±0.03
Mean ±SD		0.0811±0.005							
Max.		0.2871±0.030							
Min.		0.0029±0.000							

Through the results presented in the above tables, it is found that cancer patients were exposed to a high level of cadmium. Some studies have shown that there is heavy metals pollution in Babil Governorate as a result of human and military activities (Al-Hamzawi et al., 2015) and (Obayes et al., 2019). Statistically significant difference in cadmium levels in urine between healthy group and cancer patients was observed by independent sample test ($P < 0.005$). Figure 2: A: shows the cadmium concentration in urine sample of cancer and healthy groups. The mean value of cadmium concentrations in urine samples of the study groups as a function of the smoking habit plotted graphically Figure 2: B. As presented in this figure the mean value of cadmium concentration of smokers and non-smokers of cancer patients group is $(0.3073 \pm 0.016) \mu\text{g/l}$ and $(0.2842 \pm 0.015) \mu\text{g/l}$ respectively, while

urine samples of cancer patients, as the highest value of cadmium concentrations in urine samples is $(0.7631 \pm 0.043) \mu\text{g/l}$ male, suffering of prostate cancer returns to age of 91 years old from Kahtoniah and the minimum concentration of cadmium in urine samples is $(0.0107 \pm 0.002) \mu\text{g/l}$, male, suffering prostate cancer returns age 80 years old From Gbalih and . The average value of cadmium concentration in samples of urine for this group was found $(0.2950 \pm 0.015) \mu\text{g/l}$.

The table 3: shows the cadmium concentration in urine sample of healthy group of Babylon Governorate from this table the highest value obtained was $(0.2871 \pm 0.030) \mu\text{g/l}$ male, 56 years old, from Al-Qasim and the minimum value $(0.0029 \pm 0.00) \mu\text{g/l}$ male, 77 years old, from Al-Bakerly With average value $(0.0811 \pm 0.05) \mu\text{g/l}$.

the mean value of cadmium content of smokers and non-smokers of healthy group is $(0.0892 \pm 0.005) \mu\text{g/l}$ and $(0.0737 \pm 0.004) \mu\text{g/l}$ respectively. The concentrations of the cadmium in urine samples of smokers for the cancer groups are extensively higher than non-smokers. This finding indicates that smokers have a high accumulation of toxic elements in their bodies than non-smokers. The smoking is the major source of cadmium (Cd) intake via the humans. The content of cadmium in cigarettes generally contains 1–2 µg cadmium (Al-Hamzawi., 2015), (Afridi et al., 2010), (Bernhard et al., 2005). Figure 2: C It was also found that the cadmium concentration is high in people aged ranged from 60-69 as the (Cd) concentration is $0.36138 \mu\text{g/l}$ in cancer patients, while it is low in healthy people aged 60-69 with a concentration of $0.12615 \mu\text{g/l}$.

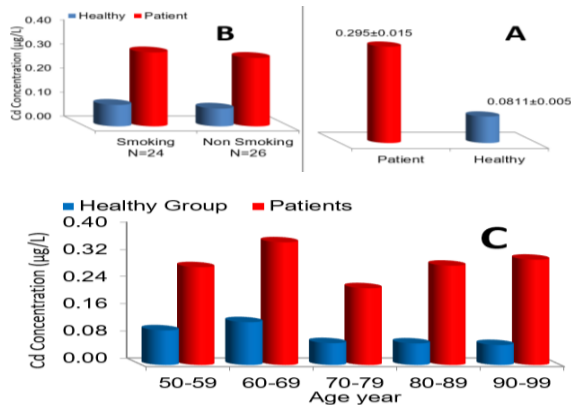


Figure 2: A: concentration cadmium (µg/l) in urine samples of cancer patients and healthy groups. B: Average value of cadmium (µg/l) in urine sample of smoking and non-smoking of study groups C: cadmium concentration in urine samples of study groups as function age.

4. 4. comparison with other results

Table 4: represents the comparison of the present results with the results of other researchers for the different countries. The results of the present investigation show that the cadmium concentrations in urine of cancer patients and healthy group are $0.2950 \pm 0.015 \mu\text{g/l}$ and $0.0811 \pm 0.005 \text{ppb}$ respectively. The average values of cadmium in the obtained urine samples are higher than acceptable values. These results show that the affected people were exposed to high levels of cadmium as a results of man-made activities. Table (4) shows the cadmium concentration in urine from the current study with other studies. This table shows that the highest values of heavy metals are in Egypt (Mortada et al., 2002) and Spain (Gil, et al., 2011).

No.	Country	Cd µg/l	Reference
1	Selected regions in Iraq	0.075	.Al-Hamzawi et al.,(2015)
2	UK	0.0003	White et al.,(1998)
3	China	0.0039	.Zhifang et al., (2008).
4	Egypt	1.94	Mortada et al., (2002)
5	Spain	0.25	Gil et al., (2011)
6	Germany	0.00016	Heitland et al., (2006)
7	Twain	0.0095	Hornig et al.,(2002)
8	In preset study	0.2950 ± 0.015	Current study

5. Conclusion

The present results exhibited that the cadmium concentration in urine samples of the cancer patients are higher than those of the healthy group and cadmium concentration for smokers of cancer patients group and healthy people are higher than the average values for non-smokers. In addition, it reveals a direct relation between the cadmium exposure and cancerous disease. The results of the present investigation are higher than ICRP references mean value of cadmium in urine $0.5 \mu\text{g/l}$.

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