MAAEN JOURNAL FOR MEDICAL SCIENCES

Volume 2 | Issue 1 Article 6

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Recommended Citation
kadhim, Shaymaa awad; Hamza, Zahra Mousa; Al-Jbory, Adnan Hasson; Jabbar, Hussein Ali; and Abdulridha, Teebah Talib (2023) "Assessment of the Pulmonary concentration of Lead and Cadmium in patients with Lung Cancer in Najaf".," *Maaen Journal for Medical Sciences*: Vol. 2 : Iss. 1 , Article 6.
Available at: https://doi.org/10.55810/2789-9136.1017

ORIGINAL STUDY

Assessment of the Pulmonary Concentration of Lead and Cadmium in Patients with Lung Cancer in Najaf

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Abstract

One of the most dangerous malignancies is lung cancer. Better treatment is made possible by the early detection of this illness. This study's objective was to measure the serum levels of lead and cadmium (heavy metals) in healthy individuals (H.G.) of both sexes and compare those levels to those in individuals with non-healthy lung cancer (L.C.). 101 blood serum samples were gathered from the Middle Euphrates Cancer Center in the Iraqi province of Najaf, consisting of 54 males and 47 females. Using an FAAS, the levels of serum cadmium and lead were examined (flame atomic absorption spectrophotometer). The respective mean serum levels of lead and cadmium were 3.73538 ± 0.067131 µg/L and 8.92525 ± 0.02314 µg/L for health men, 9.34477 ± 0.04122 µg/L and 6.08752 ± 0.05112 µg/L for lung cancer men while 6.63905 ± 0.030212 µg/L and 20.94029 ± 0.2910 µg/L for health female, 8.75170 ± 0.23401 µg/L and 12.93259 ± 0.6032 for lung cancer female, it is generally higher than the permissible limits,which consequently increases the health risk of the exposed individuals.

Keywords: Lung cancer, Cadmium, Lead, Pearson, Najaf

1. Introduction

A large range of illnesses known as cancer are characterized by unchecked cell proliferation that causes them to multiply uncontrollably and develop into immortal tumors that spread to surrounding bodily parts [2]. After cardiovascular illnesses, cancer is the second biggest cause of mortality worldwide [3]. Throughout the body, cancer can develop everywhere. Men and women are both significantly affected by lung cancer. One of the most common cancer diagnoses worldwide and the leading cause of death from cancer is lung cancer [4]. Almost 90% of people with LC die within five years of their diagnosis, indicating a terrible prognosis [5]. Developing a trustworthy method for LC early identification is essential because the disease's incidence and fatality rates are still so high [6]. Small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC) are the two types of lung cancer, with the latter accounting for about 80% of all cases in these patients. Just 26% of patients have stage I illness and may be candidates for surgery if they are healthy enough [7]. In the medical field, spectroscopy is beginning to show promise as a diagnostic tool for learning more about the many chemical and morphological structures of healthy and sick tissues [8]. Blood, which serves as the body's main circulatory medium, is a reflection of the physiological and pathological changes that take place in the tissues and affect the composition of the numerous plasma and cellular elements [7]. Cancer and traces of substances In recent years, there has been a definite interest in the levels of trace elements and heavy metals in humans as well as if these levels alter in correlation with malignant diseases, that is, whether an increase or reduction in these levels might result in significant harm like toxicity [9]. Since trace elements are required in extremely minute levels for life to continue, their absence in an organism results in death or severe dysfunction. In live tissues, trace element

Received 13 April 2023; accepted 28 April 2023.
Available online 31 May 2023

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https://doi.org/10.55810/2789-9136.1017

concentrations range from 0.01 to 100 mg/kg [9]. If people and animals consume large amounts of food over an extended period of time, all the necessary trace elements can be harmful [10].

The main difference between trace elements and heavy metals is that trace elements do not cause harm at low amounts. In general, heavy metals are harmful at very low amounts. Several trace elements are created and deposited in the fluids and tissues of humans, where they can carry out different functions depending on their chemical composition [11]. Due to human activity, particularly industrial activity and waste management, cadmium permeates the environment [12], It has long been understood that the element lead (Pb) is harmful. Lead levels rise as a result of numerous human activities and eventually make their way into humans' food and drinking water. Anemia,renal injury, encephalopathy, neurophysiological abnormalities, hypertension, blood poisoning, and kidney failure are all effects of heavy lead exposure [13]. Food is likely the primary way that people are exposed to cadmium (Cd), and cigarette smoke is a substantial source of cadmium toxicity that contributes to various health issues like cancer, cardiovascular disease, and hypertension. Human carcinogen status for cadmium. Other issues caused by cadmium exposure include cancer, heart disease, and hypertension. An agent that causes cancer in humans is cadmium [14]. Ufuk et al. measured serum levels of copper (Cu), lead (Pb), zinc (Zn), iron (Fe), cobalt (Co), cadmium (Cd), manganese (Mn), and magnesium in (LC) patients to evaluate the relationship between specific mineral, trace element, and heavy metal levels in these people. There have been many studies in the field finding the relationship between cancerous diseases and increasing the concentration of some heavy metals (Mg). The results suggested that these minerals might have an impact on (LC) patients [15]. According to Katarzyna et al., their objectives were to examine the relationships between clinical, socioeconomic, and dietary information and serum and whole blood Cu and Zn levels, as well as the relationship between Cu and Zn status and all-cause mortality in LC. Increased whole blood Zn levels, serum Cu levels, and Cu/Zn ratios have all been linked to a decreased chance of passing away in LC patients [16]. In advanced non-small cell LC patients, Sookyung et al. investigated the predictive value of ferritin to hemoglobin ratio. In patients with advanced NSCLC, they discovered that the ferritin to hemoglobin ratio, a putative measure of tumor growth, was a significant predictive factor for OS and had a direct association to survival time [17]. In order to study the correlations between the statuses of serum and whole blood Cu and Zn, Katarzyna et al. used atomic absorption spectrometry. They also used clinical, sociodemographic, and nutritional data to look into the relationship between Cu and Zn status and all-cause mortality in LC. A greater serum Cu level, Cu/Zn ratio, and whole blood Zn level were found to have unfavourable effects on LC patients' risk of all-cause mortality [18]. There were two studies, one of which was to measure the decrease in copper, manganese, and nickel concentrations and the increase in zinc and iron for breast cancer patients compared to healthy subjects [19] also, there was a study to measure the concentration of silver, lead and cadmium for breast cancer patients in Najaf, Iraq [1].

Atiyah et al., study compared the levels of trace metals (Cu, Zn, and Ni) in breast cancer patients with LC and healthy women. Findings Females with LC and healthy females had much lower serum Cu levels than females with breast cancer [20].

This study compared the serum levels of cadmium and lead in healthy male and female groups with non-healthy (lung cancer) groups at the Euphrates Center for Cancerous Tumors in Najaf, Iraq. The goal of the study was to raise people's knowledge of the hazards of heavy metal poisoning connected to their daily lives (such as Cd and Pb) in order to lessen their exposure to those risks.

2. Flame atomic absorption spectroscopy (FAAS)

The work mechanism that was employed to finish the research is shown in the chart below. Flame atomic absorption spectrophotometer was used to estimate trace elements and heavy metals at very low quantities in the blood:

In the Pharma Chemistry Laboratory of the College of Pharmacy at the University of Kufa, samples were analyzed using a Shimadzu model AA-6300 Flame Atomic Absorption Spectrometer (FAAS), as shown in Fig. 2. (see Fig. 1)

3. Results and discussion

3.1. Statistical analysis

Statistical analysis (independent sample T test) was used to analyze the data using SPSS Version 20. In light of whether We also conducted the Pearson correlation test to determine how closely the studied groups are related to one another and whether there is any statistical significance. If the (p value 0.05), the relationship between the concentration of groups is

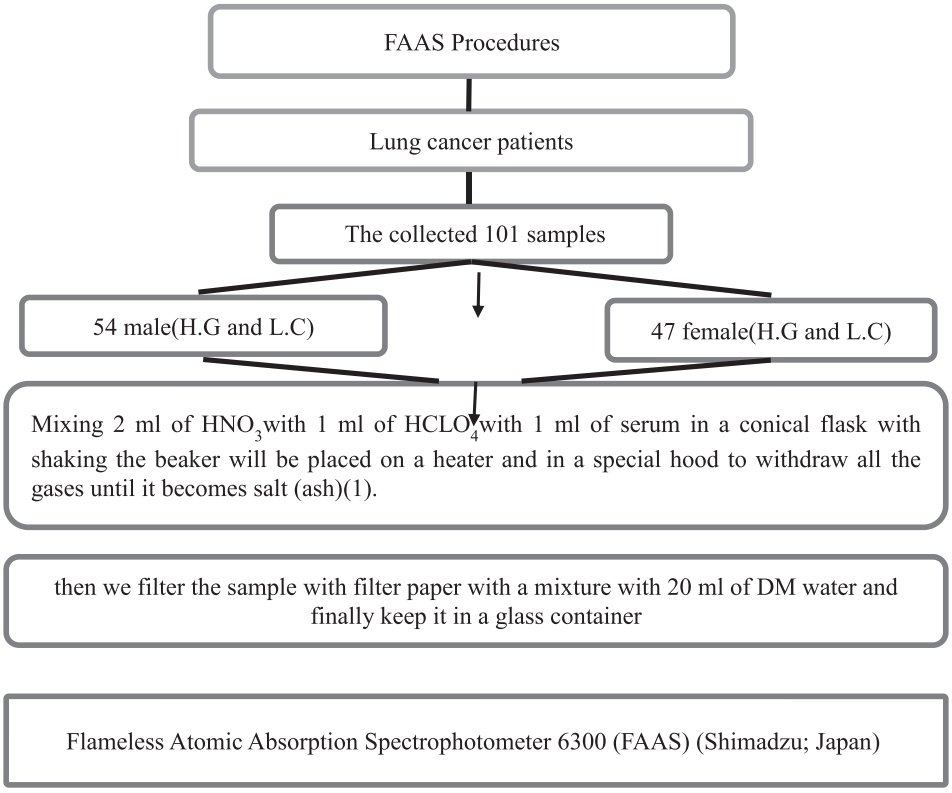

Fig. 1. A flow chart explains the FAAS procedures.

statistically significant. If it is larger than 0.05, it is not [21].

It also seeks to link the concentration of (heavy metals) with access to early detection in order to accurately conceptualize the possibility of monitoring one of the forms of malignant diseases. Consequently, as shown in Figs. 3 and 4, diluted concentrations were created for the element to calibrate the device for the element separately.

Fig. 2. Atomic absorption spectroscopy device with flame attachments.

According to Table 1, the examined populations include healthy individuals and lung cancer patients. There were 21 healthy men with an average age of 35–78 and 32 non-smoking lung cancer cases, for a total of 53 instances of men for comparison. The total number of women for comparison is 44 cases, which includes both healthy women and lung cancer patients. There were 16 healthy females with an average age of 57–33 and 28 non-smoking lung cancer patients with an average age of 85–33 in the table.

It is clear from Table 2,that the average concentrations of lead between male lung cancer patients (9.34477 ± 0.04122) are higher compared to healthy

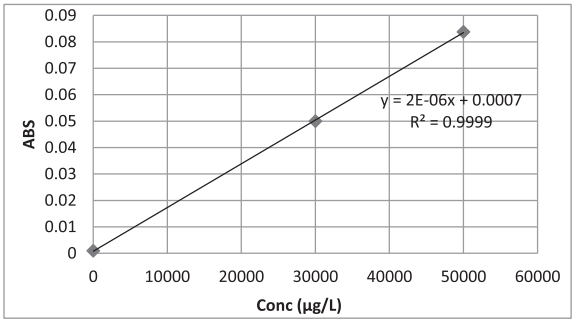

Fig. 3. Calibration of the atomic absorption system for Pb.

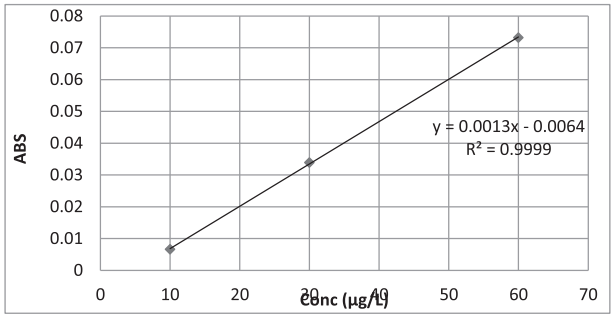

Fig. 4. Calibration of the atomic absorption system for cadmium.

Tables 1. The descriptive lung cancer (L.C) patient information and healthy samples (H.G).

Gender	Group	N	Age group	state
Male	H.G	21	78–35	No smoking
	LC patients	32	85–35	
Female	H.G	16	57–33	No smoking
	L.C patients	28	85–33	

males (3.73538 ± 0.067131) and as in Fig. 5. Also, the concentration of lead between females with lung cancer was higher (8.75170 ± 0.23401) compared to healthy ones (6.63905 ± 0.030212) and as shown in the statistical Fig. 6.

It can also be noted from the same table that the average concentrations of cadmium reversed the behaviour of lead, so it was higher for healthy men (8.92525 ± 0.02314) compared to the injured (6.08752 ± 0.05112) and also for infected women, the concentration was lower (12.93259 ± 0.6032) compared to healthy women (20.94029 ± 0.2910), as shown in Figs. 7 and 8 below, It should be noted that the concentration unit was in micrograms per litre.

Also by using SPSS program version 20 Data were processed statistically by the Pearson correlation factor was also applied between all the studied groups to the concentration of the two heavy elements, lead and cadmium, for females and for sick and healthy males. And a significant statistical significance of 0.001, less than 0.05.

Also comparing our results, can see that the values are similar to some studies but not to others,

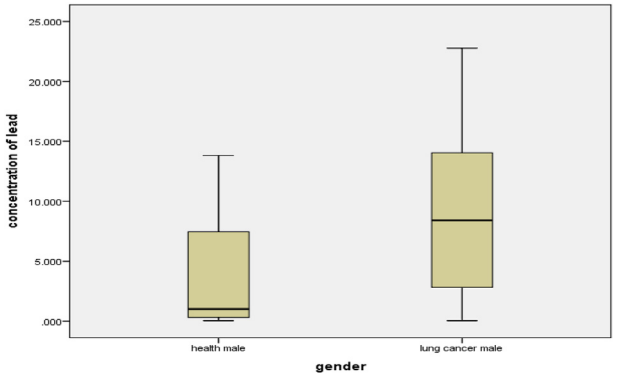

Fig. 5. Comparison of serum concentrations lead(µg/L) between health and lung cancer males.

Fig. 6. Comparison of serum concentrations cadmium (µg/L) between health and lung cancer males.

which is normal due to differences in the geology of the area of residence, the type of food consumed, the use of nutritional supplements or therapeutic supplements, as well as the nature of people's work, all of which cause changes in element concentrations. As shown in Table 3 below.

According to the findings, Iraqi LC patients had higher serum levels of Cd and pb than cancer patients from other nations. Cadmium is discharged into the environment by human activities, particularly industrial operations and waste disposal [27]. Increased Cd levels have previously been

Table 2. Comparison of the mean concentrations(µg/L) of the heavy element lead and cadmium for healthy and lung cancer for both gender.

Heavy metals	gender	Group	No. of sample	Mean ± SD. Deviation	(P value)
Pb	M	Healthy Group	21	3.73538 ± 0.067131	0.003
		L. C patients	35	9.34477 ± 0.04122	
	F	healthy	14	6.63905 ± 0.030212	0.255
		L. C patients	30	8.75170 ± 0.23401	
Cd	M	Healthy Group	20	8.92525 ± 0.02314	0.086
		L. C patients	34	6.08752 ± 0.05112	
	F	Healthy Group	14	20.94029 ± 0.2910	0.085
		L. C patients	33	12.93259 ± 0.6032	

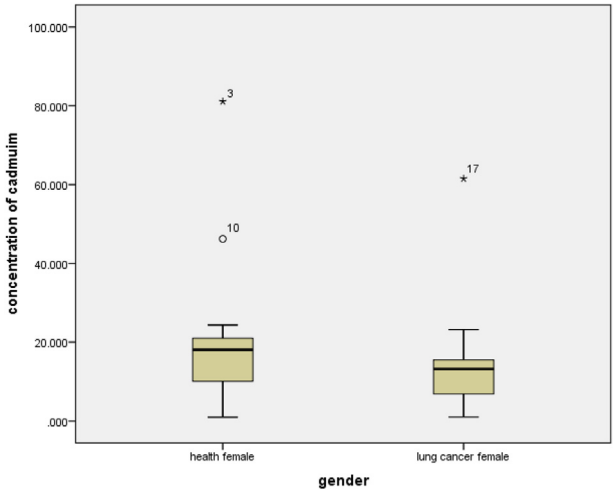

Fig. 7. Comparison of serum concentrations cadmium (μg/L) between health and lung cancer females.

Fig. 8. Comparison of serum concentrations lead(μg/L) between health and lung cancer females.

documented in healthy Iraqis. Thus, it is important to pay attention to the causes of pollution in Najaf. the same results were observed, showing a trend of greater levels of heavy metals in LC patients' serum.

Ultimately, toxic exposure to cadmium and lead can have a wide range of negative effects on a person's health, including fatal outcomes. Ingestion, inhalation, or skin absorption are all possible routes of exposure. However, the primary route of accumulation in the human body is through food intake. Toxic metals may enter the body through contaminated foods, such as fruits and vegetables that make up the majority of essential nutrients for the human body, and cause chronic problems over time even at low levels of toxicants such as cadmium and lead.

4. Conclusions

In this investigation, lead and cadmium concentrations were found to be higher than allowed and may be hazardous to health in both healthy and unhealthy persons. These concentrations are typically higher than the permitted values for both elements (WHO, 1996).

Lead concentrations were often higher in patients than in healthy participants for all samples, which is the exact reverse of cadmium's behavior.

Calculations allow one to draw the conclusion that males with lung cancer have higher lead concentrations than females who have the disease.

Table 3. Global comparison among mean serum lead, and cadmium levels for patients and healthy.

No.	Country	Mean			Type	Reference
			Patients	H.G		
1.	Iran	Pb	5.546 ppb	4.927 ppb	prostate	[9]
		Cd	2.642 ppb	0.52 ppb		
2.	Iraq	Pb	12.993 ppb	12.249 ppb	breast	[1]
		Cd	0.7 ppb	0.7 ppb		
3.	Taiwan	Pb	2.25 ppb	1.13 ppb	breast	[22]
4.	YuzuncuYil	Pb	17.88 ppb	2.68 ppb	Colon	[23]
		Cd	1.832 ppb	0.27 ppb		
5.	Yuzuncu Yil	Pb	2.227 ppb	0.641 ppb	lung	[10]
		Cd	0.35 ppb	0.25 ppb		
6.	Turkey	Pb	22.27 ppb	6.41 ppb	lips and oral cavity	[24]
		Cd	0.313 ppb	4.88 ppb		
7.	Pakistan	Pb	12.73 ppb	5.38 ppb	Colorectal	[25]
		Cd	0.563 ppb	0.264 ppb		
8.	Yuzuncu Yil	Pb	17.88 ppb	2.68 ppb	Colon	[23]
		Cd	1.832 ppb	0.27 ppb		
9.	Asturias (Spain)	Pb	1–5 ppb	Ranges for the trace elements	hemodialysis patients	[26]
		Cd	0.5–5.0 ppb			
10.	Iraq, Najaf	Pb	9.34477 ± 0.04122(m)		Lung cancer	Present study(μg/L)
			8.75170 ± 0.23401(f)			
		Cd	6.08752 ± 0.05112(m)			
			12.93259 ± 0.6032(f)			

***The units of the lead and cadmium concentrations in the table were converted into (ppb) units which are equal (μg/L)in our study.**

Moreover, healthy females had greater levels of cadmium than healthy males did.

Ethical approval

The local ethics committee gave its approval to the study protocol.

Disclaimer

None declared.

Funding disclosure

The Financial support by ourselves.

Acknowledgement

The authors are especially grateful to the Kufa University College of Science in Iraq for helping to complete this work, also extend my thanks to the staff of the Middle Euphrates Oncology Center, Najaf.

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