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Monitoring of cadmium and iron concentrations in healthy and prostate cancer patients in the Middle Euphrates Cancer Center, Najaf, Iraq

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***Abstract*---**Prostate cancer is one of the most dangerous diseases that can cause death, although the cause is unknown. Nowadays, trace elements play a variety of roles. Although their roles (e.g. cadmium (Cd) and iron (Fe)) are still unknown, they might be involved in this type of cancer. This study investigates the concentrations of these elements in prostate cancer patient's serum and then compared with a control group one. This study included a total of 100 samples. The samples were split into two groups: 50 healthy controls and 50 infected males of the same age and family history. Cd and Fe levels in serum were evaluated using an Atomic Absorption spectrophotometer (AAS) after sample preparation. In prostate cancer patients, Cd and Fe levels were seen to be high. To illustrate, To illustrate, the highest values of the mean of the concentration of iron and cadmium were (1.811 ± 0.779) and (0.092 ± 0.009) for the new case of cancer patients, while the lowest values were (0.689 ± 0.281) and (0.034 ± 0.026)) for health, respectively. The correlation between serum concentrations of these elements and prostate cancer supports the hypothesis that exposure to Cd and Fe enhances the risk of prostate cancer. Exploiting findings have the potential to reduce the time it takes to diagnose and treat a disease. More research and investigations with more samples are highly recommended to evaluate whether heavy metals play a role in the development of malignant disorders.

***Keywords*---**Trace elements, Prostate cancer, Atomic absorption Spectrophotometer, Cancer risk.

Introduction

A few characterizations have recently been developed to arrange data regarding the substance and physiological role of chemical elements in the body. One of the characterization standards, without extensively investigating them, is the classification of chemical elements into three groups depending on their presence in vertebrates and humans[1].

The first group in this order is "macro elements", which have a concentration level in the body of more than 0.01 percent. This includes the elements of N, Ca, P, K, O, Na, S, Cl, Mg, C, and H respectively. The actual body content of these elements ranges from a few grams (Mn) to almost forty kilograms (for adults weighing 70 kilograms) (O). Because of their role in tissue and organ function, a few elements of this group are referred to as "organogens" (e.g. oxygen, hydrogen, carbon, sulfur, nitrogen, and phosphorus) [2].

The second group is the "trace elements," which have focus scopes ranging from 0.00001 percent to 0.01 percent. In this regards, elements such as Cu, Br, Si, Cs, I, Mn, Fe, Al, Pb, Rb, Cd, B, Zn, F, Sr, Mo are all included in this category. These elements are found in the body in an amount ranging from a few milligrams to a few grams. However, having known that the trace elements are small in term of their content, they are not of negligible role as biological substances. To illustrates, the trace elements are considered as components being part of the complicated physiological system, which then included in the regulation of key functions across all parts of the development of living organism[3].

The third group is "ultratrace elements," which have concentrations of less than 0.000001 percent. This includes Ba, Ti, Ag, Sn, Be, Ga, Se, Co, V, Cr, As, U, Th, Rh, Ni, Li, Ge, Hg, Sc, Zr, Bi, Sb, Ti, Ag, Sn, Be, Ga, Se, Co, V, Cr, As, U, Th. It contains less than a gram of material inside the human body. There are components which are important for the living organism in this group, namely Co, Se, and C [4].

The World Health Organization has identified 19 elements that are important for a healthy body. For example, these include Cd, Ni, As, Zn, and Se[5] . Cancer's development and its link to trace elements are yet unknown [6]. Weight increase, a poor diet, drinking, smoking, sexual and physical activity, and the increasing use of the prostate specific antigen(PSA) test in recent years for early identification of prostate cancer,[7], increase the risk of developing this disease, in addition to,genetic and environmental factors play a vital role in the growth and reproduction of malignant cells directly by triggering cancer pathogenic pathways or hereditary genes for disease.[8]. Indirect pathways imply hormonal regulation or metabolism as a result of carcinogenic elements' involvement. [9].

According to the Iraqi Cancer Council (Iraqi Cancer Council 2011), prostate cancer affects 2.78 people per 100,000 in Iraq, although the incidence of this disease is unknown.[10] The trace elements such as Fe, Pd, and Co have the potential to cause cancer in humans. The epidemiological evidence support this argument up. The cadmium was noticed to play a significant role in the rise of the number of fatalities caused by prostate cancer[11].

Some reports have argued that there might be a link between prostate cancer and mineral concentrations in the human body. The latter might be evidenced by biochemical research, and these minerals include Mg, Se, Mn, B, Ca, Zn, Co, Cr, and Fe. [12, 13] According to recent studies, heavy metals are important components in human blood, and they should be employed as biomarkers to diagnose a variety of disorders, including cancer. [14]. The study's main goal is to conduct a practical investigation in the field of prostate cancer using physical techniques, then statistically analyze the results using the SPSS statistical program in the purpose of developing a method for accurately diagnosing this deadly disease and taking the necessary treatment measures to reduce the number of deaths.

Materials and Methods

Three milliliters of blood were drawn from fifty (50) men diagnosed with prostate cancer at the Middle Euphrates Cancer Center and fifty (50) healthy people at the Najaf Governorate's Main Blood Bank. The blood samples were centrifuged in order to collect the blood serum, which was then frozen at -20°C for use in preparing the samples for measurement. To digest the serum protein particles, under 85°C, a ratio of 2:1 ml of a mixture of NHO3 acid and HClO4 acid to serum was adopted. Deionized water was used to dilute the fully digested materials with 20 ml each sample, which was then filtered using 0.4 m type filter paper before being analyzed with a Flame Atomic Absorption Spectrophotometer (F-AAS) type 7000A Shimadzu, Japan. The measurement findings are expressed in parts per million (ppm).[15, 16]·

Statistical Analysis

The data were statistically processed using IBM's SPSS version 20.0 statistical tool. Analysis of variance (ANOVA), multiple regression, and Pearson's correlation were used to find differences, links, and relationships between variables in the groups. P- value of less than 0.05 was used to determine statistical significance. Also, using a mean ±SDto express the results.[17].

Results and Discussion

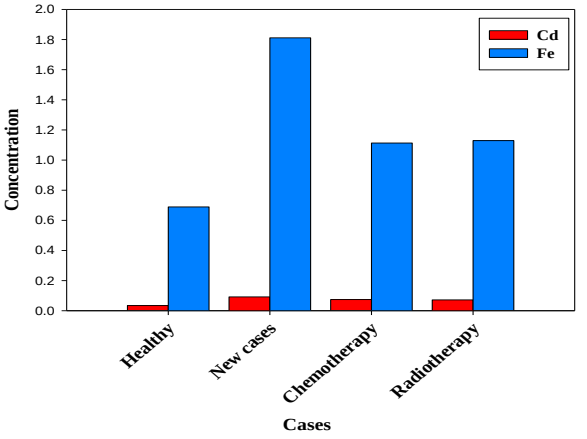
Trace element concentrations are shown in table 1. In this table, we can notice that new cases of prostate cancer had the highest mean concentrations of elements of iron and cadmium at (1.811±0.779 and 0.092±0.009) respectively, compared to those persons who take doses of chemotherapy and radiotherapy, where their corresponding concentrations were (1.113±0.189 and 0.074±0.014) and (1.129±0.047 and 0.072±0.008) respectively. Also, according to the results of this work, we found that the lowest average concentrations of Fe and Cd were for healthy people at (0.689±0.281 and 0.034±0.026) respectively.

Nevertheless, it can be noted that the values of the concentrations of the elements taken in this study for people who receive doses of chemotherapy and radiotherapy were almost comparable and fewer new cases, this is because these doses might causes great damage to cancer cells that need blood vessels to supply them with oxygen and additional nutrients compared to normal cells18]

Table1:The trace element concentration in healthy and prostate cancer (New cases Chemotherapy and Radiotherapy) according to ANOVA -test.

Trace elements (ppm)	Cases	Concentration				
		Number	Max.	Min.	Mean±St.Dev.	P-value
Iron	Healthy	50(.5)	1.432	0.101	0.689±0.281	0.000
	New cases	13(.13)	3.566	1.204	1.811±0.779	
	Chemotherapy	32(.32)	1.845	0.884	1.113±0.189	
	Radiotherapy	5(.05)	1.178	1.059	1.129±0.047	
Cadmium	Healthy	50(.5)	0.123	0.010	0.034±0.026	0.000
	New cases	13(.13)	0.111	0.082	0.092±0.009	
	Chemotherapy	32(.32)	0.098	0.050	0.074±0.014	
	Radiotherapy	5(.05)	0.078	0.058	0.072±0.008	

For the statistical analysis revealed that there was a statistical difference in concentration of Cd and Fe (P< 0.05), in blood serum. Also for the ANOVA -Test, it was seen that there was a statistical difference in the concentrations of iron and cadmium, due to the increase in their concentration in relation to the new case. Pearson's correlation factor between cadmium and iron concentrations was 0.596, which reflects a positive correlation with high statistical significance



Figure(1) The relationship between the concentrations of iron and cadmium, measured in ppm, and the number of cases for patients and healthy.

From Figure 1, we were d that the maximum value of the concentration of elements measured in this study were (3.566 and 0.111) in new case for iron and cadmium, and the minimum values were (0.101and 0.010) in the healthy group for iron and cadmium respectively.

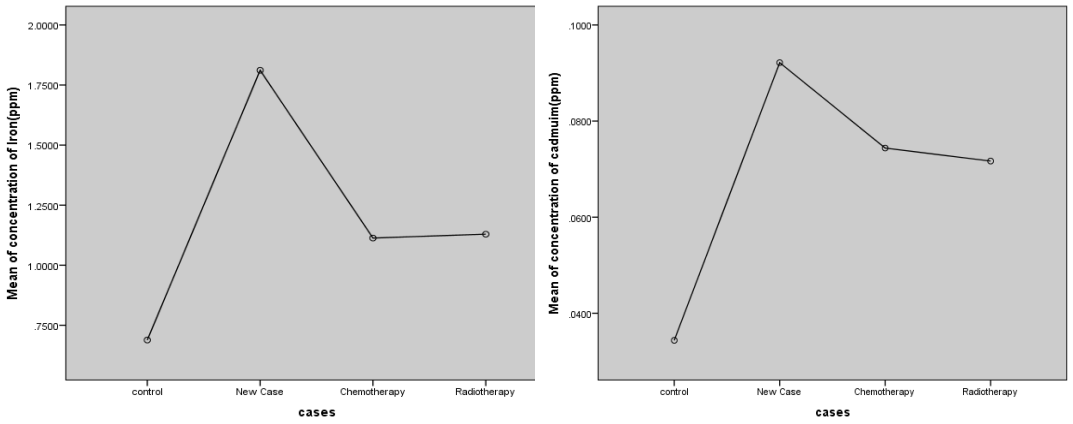


Figure 2 A comparison of the mean values of the concentrations of all trace elements examined for prostate cancer patients and health in the SPSS statistical program.

Conclusions

We can conclude, according to the resulted data, that there was an increase in the levels of iron and cadmium concentrations was that might be caused by the presence of prostate cancer in the new cases registered with this disease, while we were noted a decrease in the concentrations of these elements in patients who take chemotherapy and radiotherapy. These doses also lead to a decrease in the number of blood cells, which leads to iron deficiency anemia.

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