

The Effects of Chromium in Some Biochemical and Hematological Parameters in Bulqiza Population

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Abstract

The use of metals by humans for thousands of years has resulted in the increase of their concentration in Biosphere. The environment around mines, foundries and metal refining fabrics accumulated heavy metals, which started to be a potential danger for the flora, fauna and humans around. The aim of this study was the measurement of the environment pollution by heavy metals (specifically chromium), around the areas (which were specified formerly as polluted) of Bulqiza by using a series of biochemical and hematological biomarkers. In the study participated two population groups: 40 patients who works at mines and 40 other patient who do not. This sample consists of ambulatory patients submitted for routine control in clinic biochemical laboratory and hospitalized patients in relevant departments in the regional hospital of this city.

Biochemical biomarkers that were measured are: the activity of alanine aminotransferase enzyme (ALT), glycemia, creatinemia and urea in blood. The hematological biomarkers: amount of hemoglobin (Hb), the number of erythrocytes and the number of leukocytes.

The results of biochemical analysis showed that the values of ALT, glycemia, creatinemia and urea were in a significant scale ($p > 0.05$) higher in the blood plasma of patients in polluted area (Bulqiza), compared to the reference values (Peshkopia). In the blood of patient from polluted area we found a lower value of hemoglobin and the number of erythrocytes compared to the blood of patients from referent area.

There is a difference between the values of hematological (leukocytes, erythrocytes, hemoglobin) and biochemical parameters (glucose, urea, creatinine, uric acid) in males and females in polluted area (Bulqiza).

The results of this study make an emergent call to take the biological samples of all residents (people), who live around the polluted areas for analysis so the potential danger for their health can be avoided.

KEYWORDS: heavy metals, chromium, biomarkers, Bulqiza, Peshkopia.

1. Introduction

Metals have been used throughout much of human history to make utensils, machinery, and so on, and mining and smelting supplied metals for these uses. These activities increased environmental levels of metals. The toxic effects of metals usually involve interaction between the free metal and the cellular target. These targets tend to be specific biochemical processes and/or cellular and subcellular membranes. [4] [2]

[11]. Because chromium occurs in ores, environmental levels are increased by mining, smelting, and industrial uses. The levels of this metal are generally very low in air, water, and food, and the major source of human exposure is occupational. Chromium occurs in a number of oxidation states from Cr+2 to Cr+6, but only the trivalent (Cr+3) and hexavalent (Cr+6) forms are of biological significance [6] [9]. Although the trivalent compound is the most common form found in nature, the hexavalent form is of greater industrial importance. In addition hexavalent chromium, which is not water soluble, is more readily absorbed across cell membranes than is trivalent chromium. In vivo the hexavalent form is reduced to the trivalent form, which can complex with intracellular macromolecules, resulting in toxicity [5] [10] [8].

The entry routes of chromium into the human body are inhalation, ingestion, and dermal absorption. Occupational exposure generally occurs through inhalation and dermal contact, whereas the general population is exposed most often by ingestion through chromium content in soil, food, and water. The aim of this study was the measurement of the environment pollution by heavy metals (specifically chromium), around the areas (which were specified formerly as polluted) of Bulqiza by using a series of biochemical and hematological biomarkers [7] [1] [3].

2. Material and Methods

In the study participated two population groups: 40 patients who works at mines and 40 other patient who do not. The data for this study were collected by using the medical card of of ambulatory patients submitted for routine control in clinic biochemical laboratory and hospitalized patients in relevant departments in the regional hospital of the city for the period 2015-2016.

We used a standardized questionnaire to take information for the sample about: age and exposure time.

First was determined the value of the activity of alanine aminotransferase enzyme (ALT), glycemia, creatinemia and urea in blood with colorimetric, enzymatic, endpoint method. Secondly was determined the amount of red blood cells, leukocytes with manual methods and amount of haemoglobin with cyanmethemoglobin method (KampendheZijlstra, 1961). We estimated the mean value and the standard deviation for all values. The collected data are elaborated in the mathematical- statistical aspect and the results are presented in figures and graphs, which have served us to discuss and get out the conclusions. The comparison of the data between two groups was held by using student test ($p < 0.05$).

3. Results and discussion

In our study 42,5 % were females and 57,5 % were males. As we can observe from the table 5, by 40 cases occupational exposure, 7,5 % belong to patients under 10 years of exposure time, 47,5 % belong to patients 11-20 years of exposure time, 25 % from patients 21-30 years of exposure time and the other cases were over 30 years of exposure time.

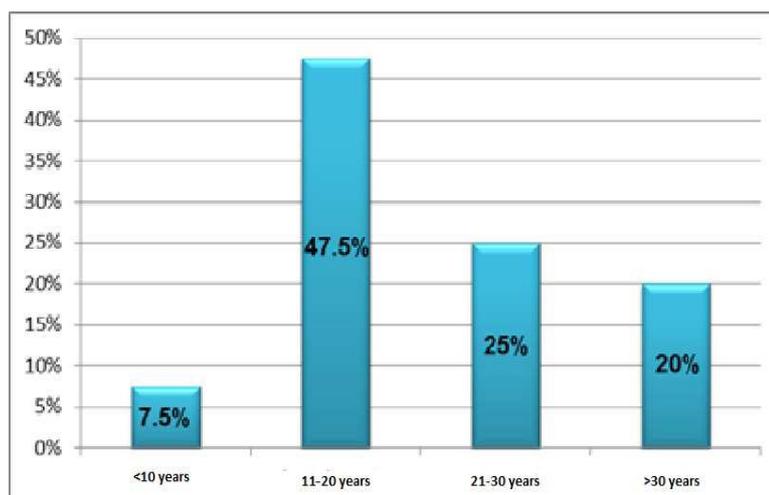


Figure 1. Distribution of patients according exposure time

In the table 1 are given our results about activity of alanine aminotransferase enzyme (ALT), glycemia, creatinemia and urea in blood in the polluted area (Bulqiza) compared to the reference values (Peshkopia) for the period 2015-2016.

Table 1 Activity of alanine aminotransferase enzyme (ALT), glycemia, creatinemia and urea

Biochemical parametres in blood plasma	Control area	Polluted area
	Peshkopia	Bulqiza
ALT	24.6±1.14	40.3±4.18
Glycemia	121±9.7	123.7±6.56
Creatinemia	0.90±0.04	0.938±0.04
Urea	45.3±3.52	49.1±2.95

*Mean ± standard deviacion

It observed that in general, the activity of alanine aminotransferase enzyme (ALT), glycemia, creatinemia and urea were higher in blood plasma from polluted site (Bulqiza city) in comparison with reference site (Peshkopia city). In the blood plasma of patients from polluted site, the value of alanine amino-transefrase is higher than reference site but not in a significant scale.

Values of the enzyme ALT (40.3 U / L) in blood plasma of patients in Bulqiza (polluted area) indicate possible disorders of internal organs, primarily damage of liver, skeletal muscles and other organs. Enzyme ALT values in plasma vary from 0 to 49 U / L. In our study's ALT values in the blood plasma of patients from the polluted site (Bulqiza) were increased twotimes compared with the control group (24.6U / L). A major site of toxic action for metals is interaction with enzymes, resulting in either enzyme inhibition or activation. Two mechanisms are of particular importance: inhibition may occur as a result of interaction between the metal and sulfhydryl (SH) groups on the enzyme, or the metal may displace an essential metal cofactor of the enzyme.

The level of urea in the blood plasma in polluted site (Bulqiza) is higher in significant scale compared to the level of urea in reference site (Peshkopi) ($Z = -1.320, p = 0.187$). The results (table 1) showed that the level of creatinemia and glycemia showed a significant difference between two groups (polluted site and reference site). The values of tests were respectively ($Z = -0.49, p = 0.961$) and ($Z = 0.49, p = 0.961$).

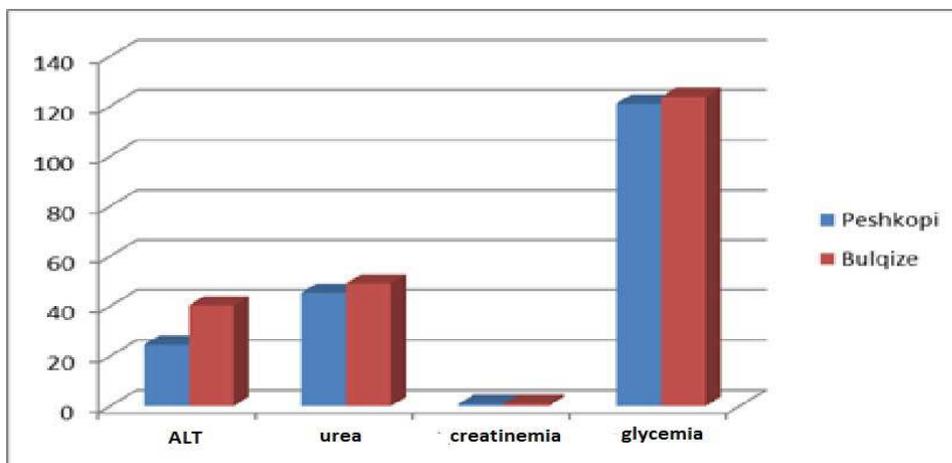
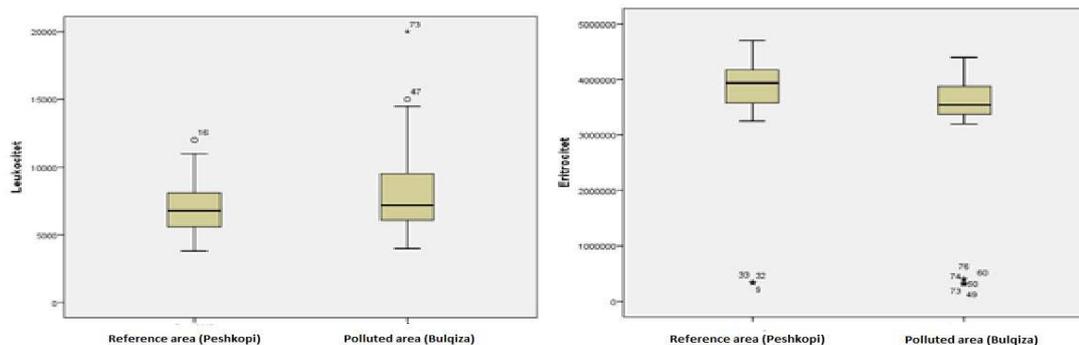


Figure 2. Comparison of average mean of biochemical parameters in both groups (polluted site and reference site)

In the table 2 are given the data for the level of red blood cells, white blood cells and hemoglobin of patients in polluted area (Bulqiza) and control group (Peshkopi). The level of red blood cells and haemoglobin is lower among patients in the polluted site but this change is not significant ($Z = -3201, p = 0.001$). As regards the number of leukocytes there is a difference between two groups of study statistically reliable with a higher value in the polluted area ($Z = 1.579, p = 0.114$).

Table 2 Level of erythrocytes, leukocytes and haemoglobin

Haematological parameters	Control area	Polluted area
	Peshkopia	Bulqiza
Erythrocytes	$364 \times 10^4 \pm 16 \times 10^4$	$317 \times 10^4 \pm 19 \times 10^4$
Leukocytes	7007 ± 299	8192 ± 515
Hemoglobin	12.2 ± 0.21	11.2 ± 0.15



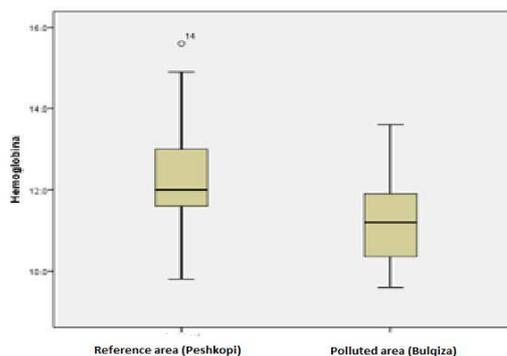


Figura 3. Level of leukocytes, erythrocytes and hemoglobin by boxplot method.

Boxplot method: percentiles indicate the boundaries of the box, the horizontal line inside the box shows mediana of the data, vertical line shows the limits of 5 to 95% of values, the values marked with * are outliers.

Low concentration of hemoglobin in the blood of individuals exposed to heavy metals such as chromium can change the properties of hemoglobin and decrease of its affinity to connect with oxygen, reduces the number of red blood cells (making them fairly fragile) (Witeska and Kosciuk, 2003).

Our study is consistent with an extended study to determine the health status of workers in 7 manufacturing plants chromate in the United States, the analysis of which showed a high frequency of erythrocytes and leukocytes of the blood compared with normal value (PHS 1953).

4. Conclusions

This study relates to the impact of chrome in ALT' activity, creatinemia, urea and glycemia, amount of hemoglobin, the number of erythrocytes and leukocytes in individuals working in the mine of Bulqiza. From the final data of this investigation it can be concluded that the level of both hematological and biochemical parameters resulted to have a difference between polluted site (Bulqiza) and reference site (Peshkopia). The results of this study make an emergent —call to take the biological samples of all residents (people), who live around the polluted areas for analysis so the potential danger for their health can be avoided.

5. References

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