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Evaluating the Differences of Minerals in Bones of Healthy and Addicted People

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ABSTRACT

Introduction: Various bone analysis methods are used clinically in examining the mineral content. In a laboratory, the effects of environmental factors such as foods, drugs, diseases and various exposures can be examined by working on samples extracted from bone. The current research was conducted to examine the long-term effects of exposure to drug on the content of mineral elements in the bone.

Methodology: Among the trauma patients admitted to the hospital, 35 addicted men and 42 healthy men were studied. Patients were in the age range of 18 to 47 years. The bone graft of patients was prepared and the value of mineral elements in them was evaluated.

Results: The concentration of the metals examined in this research is different in healthy and addicted subjects, so that the value of some of the most important elements such as calcium is significantly lower in the addicted people than that in healthy people. Moreover, the accumulation of toxic elements in addicted people is more than that in healthy people.

Conclusion: People with long history of using opium have lower useful elements in bone metabolism, which it might be associated with increased risk of fracture and reduced restoration ability. Moreover, higher accumulation of toxic elements in the bone often results from biological accumulation over time, which might result in short-term and long-term complications, such as skeletal and muscular pain and even cancers.

Key words: Bone, Addicted people, Minerals

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INTRODUCTION

As various bone analysis methods can be used in laboratory to obtain its content by working on the samples extracted from bone, the effect of environmental factors such as drugs and foods can be examined [1]. Providing appropriate information on changes caused by aging, changes caused by drug, and chronic diseases, such as kidney disease and cancers is also considered as advantage of this method [2]. In addition, it could be stated that these methods can be used in examining the nutrition status of patients, determining disease time, or the level of toxication. The studies have been developed so that these indicators can be used in anthropometric and forensic studies by determining the effect of the time elapsed from death on this bone content and soft tissue [3,4]. Accordingly, by determining the composition of each of these nutrients or any material consumed in the environment, such as drugs, nutritional value or toxicity of each of them can be recommended.

Different minerals content in the bones and other body tissues have been investigated by different studies. For example, investigations have indicated that Lead (Pb) accumulates in bones over time and by aging, but this accumulation is not seen in soft tissue [5,6]. Investigating the value of Aluminum (Al) accumulation in dialysis patients caused by treatment diets was also among the findings obtained by such bone analysis methods. The concentration of rare elements in the body has been also investigated in various studies and their normal values have been reported by examining them in tissue with water, dry tissue, and burned tissue, and their normal values have been reported [5-8].

It should be noted that various methods have been used

for tissue processing and various tools and techniques have been used for evaluating these substances. The important point is that there is often consensus on values of these substances reported in different studies. However, there are some contradictory views on some of these rare elements and the normal values of each of them [1,2]. Investigations have revealed that various elements have different bioavailability both in various foods and after their absorption in various tissues of body. For example, elements such as Copper (Cu), Zinc (Zn), Selenium (Se) and Molybdenum (Mo) are often found in animal proteins, and the elements such as Manganese (Mn), Strontium (Sr), Magnesium (Mg), Cobalt (Co) and Nickel (Ni) are often found in plant resources. An element such as Cobalt, as one of the vital components involved in production of vitamin B12, has a high concentration in soft tissues, while it is stored less in bones [9].

However, there are other problems, making the analysis more difficult. One of these problems is interaction and competition of these substances in the body. An element such as Copper acts as zinc antagonists in the body and their level is in competition with each other [10,11]. It is suggested that only the elements accumulated in the bone (not in soft tissue) to be examined by multi-element studies [1,2]. By introducing new methods and tools in bone analysis domain, different studies have been conducted on various populations to explain the load pattern of each of the elements in the body by considering the anthropometric indices and nutritional patterns [5-7]. Elements such as Lead (Pb), Calcium (Ca), Iron (Fe), Boron (B) and Magnesium (Mg) play specified role in body in regulating the metabolism and function of the enzymes. Various diseases such as cancer, cardiovascular disease are associated with these elements. Moreover, factors such as age, gender, diet, social habits, and diseases such as osteoporosis and kidney disease affect the value of these elements in the body [12-16]. Given the need for these demographic investigations, we decided to evaluate the differences of minerals in the bones of healthy and addicted people.

METHODOLOGY

This research is a cross-sectional type of study. The total of 77 patients was studied in this research, which 35 of them were opioid addicted men and 42 of them were healthy men used as control group. They were evaluated in terms of minerals available in bone tissue. The patients admitted to hospital and required bone graft due to fracture were randomly included in the research. The mean age of patients admitted to hospital was 18-47 years. All patients were healthy in terms of physiological and metabolic factors. The inclusion criteria of research included: (1) Male gender, (2) Age (between 18 and 47 years), (3) Full health of subjects and non-alcohol addiction.

Urea and blood tests were used to identify the addicted people. The bone samples taken from the subjects were transferred to laboratory to examine the minerals. Then, they were analyzed after entering the demographic data and other main variables of research.

RESULTS

In total, 42 healthy people (non-addicted people) with mean age of 32.87 ± 5.6 and 35 opium-addicted people with mean age of 36.12 ± 6.9 years were included in this research. ANOVA analysis was used to examine the differences between minerals measured in both addicted and non-addicted groups. The test results revealed that the

Table 1: The concentration of each of the elements measured in both groups based on ppm

Element	**Ag**	**Al**	**As**	**Ba**	**Be**	**Ca**	**Cd**
Mean (addicted)	29.038	124.6667	2.147059	21.03895	0.313636	76095.4	0.2625
Mean (healthy)	0.776667	103.4	2.046667	14.96552	0.253846	8346.6	0.256333
p-value	0.011	0.031	0.43	0.041	0.049	0.001	0.3
Element	**Ce**	**Co**	**Cr**	**Ce**	**Fe**	**K**	**Lu**
Mean (addicted)	7.75	0.460667	15.19048	24.90476	676.9545	852.6111	2.4375
Mean (healthy)	6.596	0.238947	10.16667	14.03	270.6333	989.4	2.37931
p-value	0.045	0.029	0.018	0.031	0.019	0.039	0.43
Element	**Li**	**Mg**	**Mn**	**Mo**	**Na**	**Ni**	**P**
Mean (addicted)	2.094118	2372.955	10.733273	0.858824	35.928188	6.827273	50493.4
Mean (healthy)	2.74	2320.667	4.142857	0.752069	3948.333	2.483333	53245.8
p-value	0.048	0.44	0.037	0.047	0.001	0.031	0.027
Element	**Pb**	**S**	**Sb**	**Sr**	**Th**	**Ti**	**U**
Mean (addicted)	19.95455	1635.118	1.034448	153.6818	8.34375	9.1875	3.925
Mean (healthy)	14.66667	1596.4	1.044	149.5333	7.732	4.12	3.684
p-value	0.038	0.16	0.53	0.6	0.042	0.034	0.046
Element	**V**	**Y**	**Yb**	**Zn**			
Mean (addicted)	2.5	0.982667	0.51857	127.0909			
Mean (healthy)	1.833333	0.796	0.426	103.6			
p-value	0.042	0.043	0.049	0.034			

concentration of great number of minerals is significantly different in the two groups ($p<0.05$) (Table 1).

Based on the above table and p-value, it was revealed that vital and important elements such as calcium, potassium, sodium, and phosphorus is lower in addicted people compared to those in healthy people. However, some elements, including Arsenic (As), Cadmium (Cd), Magnesium (Mg) were significantly different in two groups.

DISCUSSION

Bone content analysis methods are available at various dimensions and for different goals. The effect of geographical, racial, and nutritional factors and the effect of many diseases and conditions on the bones can be measured using these methods [1,2]. Bone databases in various countries are being formed or completed and the effect of various conditions, including aging, cancer, and addiction is being investigated in order to make more complete decisions on prevention and treatment in different countries [3-13]. Addiction to traditional drugs such as opium is one of the most common and chronic inappropriate social habits in the world, including Iran.

Comprehensive preventive and therapeutic steps are taken by various organizations to solve this problem [17-19]. Structural change in accumulation of various substances in the bone and its short-term and long-term impact on other body systems is considered as a part of advantages of such studies. Findings of this research on bone tissue in healthy and addicted people revealed that important and vital elements such as Calcium (Ca), Potassium (K), Sodium (Na) and Phosphorus (P) are different significantly in two groups and the value of these elements in addicted people is much lower compared to that in healthy people. It might reflect the imbalance in Sodium-Potassium pumping system of addicted people.

Sodium and Potassium imbalance in the body might cause nervous disorders and hearing and balance problems, and addicted people often suffer from such problems [9,19,20]. It was also revealed that the values of some elements, including Arsenic (As), Cadmium (Cd), Magnesium (Mg), Sulfur (S), Antimony (Sb), are not significantly different in two groups. In addition, the results of the research revealed that heavy elements increased the bones of addicted people and these elements due to their toxicity and abundance in the body of people cause edema, arthritis, joint pain, and chronic fatigue. These elements are also strong oxidizing agents, so they have carcinogenic potential, which occurrence of bone marrow cancers in people abusing these drugs can confirm this issue.

The results revealed that Iron (Fe), Copper (Cu), Aluminum (Al) and Zinc (Zn) increased significantly in addicted people body compared to healthy people. While increase of these elements in the body is useful, it seems that they replace the important element of calcium in the bones of addicted people and cause calcium re-absorption from bone. Comparing the current research results with these of other studies suggests that the use of opioids has been associated with reduced bone density and reduced content of most of the important elements such as calcium in the bone [17-21].

CONCLUSION

The current research results suggest that the concentration of investigated metals in the bones of healthy and addicted people is different.

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CONFLICT OF INTEREST

Authors declare there is no conflict.

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