

Original Article

Comparison of Selenium Serum Levels in Patients With Multiple Sclerosis and Normal Individuals

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Abstract

Background: Multiple sclerosis (MS) is an inflammatory and chronic autoimmune disease that manifests as nerve lesions in the central nervous system. This study measured the serum levels of selenium (Se) in MS patients and normal individuals.

Methods: Overall, 70 patients with MS and 70 thermally healthy individuals were selected for the purpose of the study. Their blood samples were poured into the buffer, and the serum was separated. Then, the serum levels of Se were measured using an atomic absorption device. Descriptive statistics were used to summarize the data, and a t-test of two independent groups was utilized for comparison. The significance level of the tests was 5%.

Results: In this study, by examining the amount of Se in the serum of both normal groups and patients, it was observed that the amount of Se in patients with MS was significantly lower than that of normal people. The findings demonstrated that the Se serum levels in the two groups of MS patients and healthy individuals were 85 ± 40 and 130 ± 30 micrograms/liter, respectively. The observed difference in the amount of serum Se at the level above 5% was significant based on the t-test.

Conclusion: The findings of this research showed that the serum levels of Se in MS patients were lower than in healthy individuals. Decreasing serum Se can play a decisive role in causing people to suffer from MS.

Keywords: Selenium, Multiple sclerosis

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Introduction

Multiple sclerosis (MS) is an inflammatory and chronic autoimmune disease that is caused by various environmental and genetic factors. The first French neurologist, Jean-Martin Charcot, introduced MS in 1868 (1). The main mechanism of the onset of the disease is not fully known, but probably environmental factors such as air pollution, viral and bacterial infections, stress, and genetic factors also play a role in causing this disease (2). According to global statistics, the prevalence of MS ranges from 5 to 112 people per 100 000, and Iran is one of the countries that has a high prevalence of MS. Almost every 100 000 people have 51 people with MS; as a result, the rate of this disease is estimated to be more than 40 000 people (3). The symptoms of the disease are extremely diverse, and depending on the location of the lesion, it can be highly severe or highly mild. It has been observed that patients

who have mild symptoms of the disease may be unaware of the presence of the disease in their body for several years and may not visit a doctor for years (4). Four clinical forms of MS are known, including: (a) Relapsing-remitting form, (b) Primary progressive form, (c) Secondary progressive form, and (d) Recurrent progressive form (5).

One of the methods of diagnosing MS is the use of magnetic resonance imaging (MRI). This method is highly sensitive in the diagnosis of MS and precisely determines the abnormalities and the location of the lesion in the patient's brain. In fact, the use of MRI is one of the basic methods for the diagnosis of MS (6). Another method for diagnosing MS is examining the cerebrospinal fluid. The presence of immunoglobulins and their levels are analyzed in this diagnostic method (7). Likewise, the sensory arousal method is used in MS patients, which measures and examines the time required to transmit the



nerve message from the organs to the nervous system, as well as the time required to create an appropriate response to sensory stimulation (8–10).

Selenium (Se), a nonmetal, is the 34th element in the periodic table, which was discovered in 1818 by a Swedish chemist named Berzelius JJ. Extremely low amounts of Se in the diet to maintain health are needed in humans and animals. In humans, the nutritional role of Se is achieved by selenocysteine, which contains 25 proteins and is called selenoprotein (SeP). SePs have many roles in the body, perhaps the most important of which is as an antioxidant, by protecting the body against oxidative risks (11). Se is highly important in the brain. During Se depletion, the Se stored in the brain is consumed by other tissues, while Se deficiency causes irreversible brain damage. SePP1 regulates brain lipids by binding to the surface receptor apolipoprotein E receptor 2 (apo ER₂). Mice that cannot synthesize SePP1 have increased spasms, abnormal movements, and spontaneous seizures. Evidence from human studies demonstrates the role of Se in seizures, coordination, Parkinson's disease, and cognitive decline. Significantly low Se concentrations have been detected in children and adults with epileptic seizures and in children with fever and seizures. In a few studies, Se supplements reduced refractory childhood seizures. SePP1 plays an important role in neuronal protection by increasing neuronal survival and preventing apoptosis in response to oxidative amyloid β . Human studies show that the risk of developing Alzheimer's disease and dementia relies on Se status (12).

Studies by Santhosh et al indicate that interfering with SePP1 function damages auditory and motor areas, at least by limiting the supply of Se to the brain (11). The study by Jensen et al revealed that the content of total blood Se in MS patients was 7% higher than the content of Se in normal people (13). Se supplements are sometimes recommended to people with MS, although no clear relationship has been determined between the course of the disease and the level of serum Se (14).

Considering that various studies on MS as a disease whose causes have not been clearly defined are increasing, this research aimed to measure the serum levels of Se in patients with MS.

This research is an important practical step in identifying the mechanisms involved in MS disease.

Materials and Methods

Two groups of patients and controls were evaluated in this case-control study. The patient group consisted of people with MS who were referred to the MS Support Association and Sina Hospital in Hamadan, whose disease was confirmed by the diagnosis of a neurologist. The control group also included healthy people who were matched with the patient group in terms of age and gender.

The arm venous blood was sampled after fully informing the patients about the research plan and the questionnaire by the project managers and obtaining written consent

from the patients and the control group.

First, 5 mL of blood samples were taken from the study population, and each blood sample was immediately poured into gel clot tubes. In addition, the serum of each was separated by centrifugation. To measure the amount of serum Se, the samples were measured by an atomic absorption device containing a Se lamp. SPSS 16 software was used to analyze the data. First, descriptive statistics were utilized to summarize the data, and t-test statistics of two independent groups were employed for comparison. The significance level of the tests was 5%.

Full information about the research plan and questionnaire was given to the patients by the project managers, and written consent was obtained from the patients.

Results

In this research, serum Se levels were measured in 70 people with MS and 70 normal, healthy people. The Se measurement method included using an atomic absorption device containing a selenium lamp.

Table 1 presents the statistical analysis of serum Se values in the two groups of people under study.

Table 2 compares serum Se values between two groups of sick and healthy people. According to the data, the average values of serum Se in these two groups were 85 ± 40 and 130 ± 30 $\mu\text{g/L}$, respectively. The observed difference in the amount of serum Se at a level above 5% was significant.

Discussion and Conclusion

MS is an inflammatory disease that leads to a wide range of neurological symptoms and physical disabilities. Several studies have proven the importance of the role of oxidative damage in the pathogenesis of demyelination and the neurological complications of these damages (15). Free radicals are associated with many pathological conditions, such as inflammation and infection. Reactive oxygen species are produced endogenously during inflammation and lipid peroxidation.

Oxidative stress is an important factor in the pathogenesis of MS. Both demyelination and inflammation are associated with the production of reactive oxygen species (16). In a study conducted by Ristori et al, it was found that the imbalance in the amount of trace elements in the serum caused a decrease in the antioxidant capacity of the

Table 1. Information on Statistical Analysis of Serum Selenium Values

Statistics	MS Patients	Normal People
Number	70	70
Mean	85	130
Standard deviation	40	30
Standard error of the mean	11	13
Middle	75	90
View	40	49
Minimum	65	125
Maximum	105	155

Table 2. Comparison of Serum Selenium Values Between Two Groups of Patients and Healthy People

Studied Groups	Number	Se (µg/L)	Mean Difference	Error Mean Difference	95% Confidence Interval Mean Difference	t	P Value
MS patients	70	85 ± 40	4.32	18.1	84-46	43.8	0.05
Normal people	70	130 ± 60	4.32	18.1	84-46	43.8	0.05

Note. Independent two-sample t-test.

serum in people with MS (17). Se is an active compound in a variety of enzymes involved in redox reactions that protect the body against oxidative damage (18). The key role of the Se element in the metabolism of the human body is related to the presence of this micronutrient in combination with glutathione peroxidase (GSH-Px) and thioredoxin reductase enzymes, and the important role of these enzymes is in their protective effects against the harmful effects of free radicals (19). Se plays its role mainly through SePs. In a study performed by Socha et al on 101 patients with MS, the levels of Se concentration and GSH-Px activity of these people were investigated, and the results demonstrated that Se concentration and GSH-Px activity in patients with MS were significantly lower compared to the control group. In addition, it was revealed that dietary habits have a direct relationship with the amount of Se in the body (20).

In the present study, the serum concentration of Se in people with MS showed a significant decrease compared to healthy people, and these results indicated a decrease in antioxidant capacity in people with MS. Further, in line with the current study, in another study conducted by Fathi et al, with a focus on the level of Se concentration in the blood of 23 patients with MS compared to 23 healthy individuals, the observations represented that the level of serum concentration of patients with MS was significantly lower than that of healthy people (21). Se is important in various enzymes, especially in the GSH-Px enzyme. Considering the role of this enzyme in antioxidant activities, deactivation of H₂O₂ produced in the body, and protection of the body against harmful factors, in another study by Dworkin, it was found that low levels of Se in the blood caused a decrease in GSH-Px enzyme activity in AIDS, indicating that the level of Se is directly related to the level of GSH-Px activity (22). Based on the findings of the current study, which are in conformity with the results of several studies, it was observed that the reduction of serum Se can play a decisive role in the development of people with MS. Due to the key role of some enzymes in reducing the destructive effects of oxidative stress in the body, as well as the presence of Se in the structure of these enzymes, we can understand the importance of this element in the body.

Authors' Contribution

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