

The Investigation Of Serum Level Of Selenium In Patients With Depression

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ABSTRACT

Introduction: Depression is one of the most important problems of human in 21th century. Considering its high prevalence, economic and health costs caused by depression and its chronic and debilitating course, it is necessary to investigate its risk factors in order to choose better methods of treatment and prevention. Selenium deficiency is believed to be a risk factor for depression. The neuroprotective activities of selenium and selenium compounds are well known, at least through their antioxidant actions, so the aim of this study is to investigate serum selenium levels in patients with depression.

Materials and methods: This study was based on a case-control study. The target population was 30 patients suffering from depression and 30 healthy controls referred to Shahid Mofateh Clinic of Yasuj. Beck Depression Questionnaire was used to determine the level of depression of participants and serum samples of participants were used to determine selenium concentrations. The collected data was analyzed using SPSS software.

Results: The average age in 30 cases with depression was equal to 41 ± 13.05 years. Most of the people suffering from depression were female which included 25 people among 30 people were the case group. There was no observed a statistically significant difference between the age, gender, and marital status variables in both case and control groups, but there was observed a statistically significant difference between the variables of education level, economic status and nutritional status of people. The average serum concentration of selenium in the case group was equal to 89.10 ± 32.21 $\mu\text{g/liter}$ and this amount in the control group was equal to 95.90 ± 36.03 $\mu\text{g/liter}$, although the observed difference between the case group was not statistically significant.

Conclusion: Although the role of selenium in depression has been discussed in some studies, but in this study no convincing relationship was found despite its lower serum concentration in depressed people.

Keywords: Selenium, Yasuj, Depression.

Introduction

Depression, is one of the most prevalent psychiatric disorder that has a wide range of adverse health outcomes including poorer physical and social functioning, reduced quality of life, and increased mortality. (1) this disorder is accompanied by crime and substance abuse. (2, 3) This disorder is common among young people, and according to

the estimates of the World Health Organization, about 4-8% of teenagers manifest symptoms of depression. Depression is characterized by severe mood disorders that persist over a long period of time and resist against the effects of external events. People suffering from depression disorders feel deep sadness, reduce their activity, lose their self-confidence and have low self-esteem (4). Depression is caused by abnormalities in neurotransmitters such as serotonin and dopamine, which is affected by oxidase monoamine enzymes or tryptophan precursor synthesizers. Increasing the concentration of serotonin in the synaptic cleft through selective serotonin reuptake inhibitors (SSRIs), is a successful strategy for the treatment of severe depression. The SSRIs is one of the dominant antidepressants drugs for the treatment of major depression in 88.5% of outpatients. (5-7) Another natural substance that is under investigation and is related to depression is selenium. Several investigations have

shown that selenoproteins are essential for multiple biological functions, which are relevant to depression. (8) The lack of elements such as selenium, zinc, magnesium, vitamin B12 and folic acid are associated with increased risk of depression. (9) Selenium is an essential element which is required for the synthesis of selenocysteine and essential for the production of selenoproteins. (10) Through these selenoproteins, selenium acts as a defense mechanism for oxidative stress, regulation of thyroid hormone activity, and for the state of regeneration of vitamin C and other molecules. (11) Selenoproteins are mainly structural or enzymatic and act as catalysts for thyroid hormone activation and as antioxidants such as glutathione peroxidase (GPX). The GPX activity is usually used as a marker for body selenium adequacy, where the serum or plasma selenium concentration required to achieve maximal GPX expression is 90-100 µg/L. However, the plasma Selenoprotein P concentration is a more appropriate marker for plasma GPX activity. (8) Peroxisome proliferator-activated receptors gamma (PPAR γ) and the selenium micronutrient can cause changes in obesity-related or mood disorders, so PPAR γ and selenium can be a powerful combination in the treatment of two co-morbidities, i.e. obesity and depression. Selenium is also able to reduce inflammatory signaling pathways (12). Therefore, according to the presented contents, the aim of this study was to investigate the level of serum selenium in a group of patients with depression.

Materials and methods

This study was based on a case-control study. The target population was included the patients suffering from depression in Shahid Mofateh Clinic of Yasuj. The inclusion criteria to the study are included the age between 18 and 80 years, not suffering from a chronic and debilitating disease, being literate at the level of reading and writing, patients' consent and no history of childbirth in the last three months, and the exclusion criteria of the study are included failure to complete questionnaires and suffering from chronic and debilitating disease, such as kidney and cardiovascular diseases.

The studied sample includes patients with depression who were selected by the method of available samples. In this way, the researcher by referring to the psychiatric clinic in collaboration with a psychiatric specialist, is identified the patients suffering from depression, and those who had the inclusion and exclusion conditions, were included to the study after obtaining informed consent and filled the Beck questionnaire (13) and then about 5cc of venous blood sample was taken to measure serum selenium level.

The collected data were analyzed using SPSS version 20 statistical software. To describe the data, central and dispersion indices, frequency distribution tables and graphs were used, then according to the normality or not normality of quantitative variables, parametric tests, including independent t-test or non-parametric equivalent such as Mann-U-Whitney were used and Chi-square test was used to correlate qualitative variables.

A written letter of introduction was received from the respected officials of the University for introducing to the research centers. A written letter of introduction was obtained from the respected officials of the selected research centers. Then, the purpose of the study was explained to all research units and a written consent was taken from them. The information of all patients will be kept confidential by the project manager. In all stages of the research, all statements of ethics in Helsinki research and ethics research committees of the University of Medical Sciences are

considered. The project was carried out after approval by the Research Council of the Faculty of Medicine and receiving the code of ethics with the number IR.YUMS.REC.2016.173 and receiving the introduction letter.

Results

In total, 60 patients were included in the study which were divided into two control and case groups. The average age in the group of patients with depression was equal to 13.05 ± 41 years and the minimum age was 22 years and the maximum age was 69 years. The average age in the control group was equal to 36.29 ± 6.25 years and the minimum age was 24 years and the maximum age was 52 years. Among 30 people in the case and control groups, 25 people (83.3%) were women and 5 people (16.7%) were men. In terms of marital status among the depressed people, 20% were single and 80% were married. Among the people in the control group, 13.8% were single and 86.2% were married. In terms of education level among the depressed people, 44.8% were illiterate, 10.3% had a degree less than a diploma and 37.9% had a diploma degree, 6.9% had an associate degree and bachelor's degree. In terms of education level among the control group, 10.3% were illiterate, 48.3% had a degree less than a diploma and 17.2% had a diploma degree, 17.2% had an associate degree and bachelor's degree and 6.9% had master's degree. In terms of employment status among the depressed people, 80% were housewives, 6.7% were employees, 3.3% had self-employed, 6.7% were students, and 3.3% were unemployed. Among the control group, 69% were housewives, 17.2% were employees, 10.3% had self-employed, and 3.4% were students. In terms of economic status among the depressed people, 30% had poor economic status, 36.7% had medium economic status, 33.3% had good economic status, and among the control group, 13.8% had poor economic status, 72.4% had medium economic status and 13.8% had good economic status. In terms of nutritional status among the depressed people, 23.8% had poor nutritional status, 14.3% had medium nutrition status, and 61.9% had good nutrition status. Among the control group, 52.2% had medium nutrition status, and 47.8% had good nutritional status. The medium BMI index in the case group was equal to 26.64 ± 5.26 , and also in the control group, the average BMI index was equal to 27.26 ± 4.35 . The average score of the Beck questionnaire in the case group was equal to 28.37 ± 6.003 , and in the control group, the average score of the Beck depression questionnaire was equal to 4.77 ± 2.012 . Among the 30 depressed patients studied, 96.7% had major depression and 3.3% had minor depression. The average serum concentration of selenium in the case group was equal to 89.10 ± 32.21 kg/liter with the lowest level of 34 and the highest level of 156 $\mu\text{g/liter}$. The average serum concentration of selenium in the control group was equal to 95.90 ± 36.03 kg/liter with the lowest level of 41 and the highest level of 191 kg/liter. According to the normal range of serum concentration of selenium which is between 70 and 150 microliters, among 30 people in the case group, 8 people had a serum selenium concentration of less than 70 and 22 people had a serum selenium concentration of more than 70. Among the 30 people in the control group, 9 people had a serum selenium concentration of less than 70 and 21 people had a serum selenium concentration of more than 70. The result of Chi-square test did not show a significant statistical relationship between the two groups ($P > 0.05$). The result of Fisher's exact test for the variables of gender, marital status, and occupation of individuals did not have a statistically significant difference ($P > 0.05$) (Table 1).

Table 1: Demographic characteristics of depression and control groups

		Groups		P-value
		Case	Control	
Gender	Male	5	5	0.635
	Female	25	25	
Marital status	Single	6	4	0.388
	Married	24	25	
	Housewife	24	20	

Occupation status	Employees	2	5	0.984
	Self-employed	1	3	
	Student	2	1	
	Unemployed	1	0	

The result of **Chi-square test** for the variables of education, economic and nutritional status had a statistically significant difference ($P < 0.05$) (Table 2).

Table 2: Characteristics of depression and control group according to education level, economic status and nutritional status

		Groups		P-value
		Case	Control	
Education level	Illiterate	13	3	0.001
	Under-diploma	3	14	
	Diploma	11	5	
	Associate and bachelor	2	5	
	Master and above	0	2	
Economic status	Weak	9	4	0.022
	Medium	11	21	
	Good	10	4	
Nutritional status	Weak	5	0	0.002
	Medium	3	12	
	Good	13	11	

The result of **Independent Samples Test** to investigate the variables of age and BMI in the case and control group had no statistically significant difference ($P > 0.05$) (Table 3).

Table 3: Comparison of depressed and control group according to age, BMI, and selenium level

Variables	Groups	Number	Mean	Standard deviation	P-value
Age	Case	29	41.00	13.058	0.093
	Control	24	36.29	6.259	

BMI	Case	30	26.648	5.26	0.628
	Control	29	27.260	4.35	
Serum concentration of selenium	Case	30	89.10	32.21	0.444
	Control	30	95.90	36.03	

The result of Pearson's test did not show a statistically significant correlation between serum concentration of selenium and Beck depression questionnaire score (Table 4).

Table 4: Distribution of the correlation between serum level of selenium and Beck's test score

		Serum level of Selenium	Beck's test score
Serum level of Selenium	Pearson Correlation	1	-.079
	P-value	-	0.546
	Number	60	60
Beck's test score	Pearson Correlation	-.079	1
	P-value	0.546	-
	Number	60	60

Discussion

Depression is one of the most common mental disorders that can be controlled in the early stages. One of the treatments for depression disorders is the use of lithium salts. Major side effects of long-term lithium therapy include thyroid disorders (mainly is presented as hypothyroidism and goiter), weight gain, edema, gastrointestinal pain, diarrhea, tremors, and kidney damage. In a study which was conducted on 202 women exposed to lithium and thyroid function, one of the indicators of thyroid function was selenium which was measured in urine. Selenium has a positive relationship with T4 and an inverse relationship with TSH, thus the findings show and confirm that selenium may have a positive effect on thyroid function and can reduce the side effects of lithium (14). One of another problem related to depression disorders is suicidal behavior, which is mainly observed in teenagers and coincides with alcohol and drug abuse. Alcohol abuse can lead to nutrient deficiencies, including selenium, which is a potent protective factor for neurons through the selenoproteins expression. Consequently, dietary supplementation with this mineral material can be part of a treatment plan for adolescents with depression and alcohol abuse (15). Postpartum depression refers to another problem during pregnancy periods or in the first 12 months after birth. Some of the studies in early pregnancy periods of women have shown that insufficient intake of certain nutrients, such as selenium, can increase the risk of maternal depression. On the other hand, the neuroprotective activities of selenium and selenium compounds are well known at least by their antioxidant actions. Oxidative damage is involved in psychiatric disorders and the development of new treatment strategies based on antioxidant compounds has great importance (16). Selenium is an essential micronutrient for humans, although it is toxic in high doses. Overall nutritional status and nutrient intake are associated with depression and a poor diet is one of the main causes of depression (17). In this study, the serum selenium level of patients with depression was investigated and compared with the control group. In this study, the average age in 30 cases with depression was equal to 41 ± 13.05 years. This amount of the average age of people in a

study which was conducted by Banikazemi et al. (18) was lower. Most of the people studied in the case group were women, which was not far from expected by considering the prevalence of depression among women. The average BMI index in the case group was equal to 26.64 ± 5.26 , which was higher than the BMI index in a study which was conducted by Conner et al. (19), although there was observed no significant difference with the control group ($P > 0.05$). Most of the people studied in the case group were married. About 55.1% of the studied subjects had education less than diploma, which was consistent with the study of Ekramzadeh et al. (20) and in this study there was observed a statistically significant difference between the education level in the case and control groups ($P < 0.05$). The economic status had significantly different in the two groups, and this result was consistent with the study of Pasco et al. (21). Although there was observed no significant difference in the occupation status of the case and control groups, it'd indicates that the amount of income caused by the job can be a factor related to a person's depression. The nutritional status of the people in the case group with the control group also had a statistically significant difference, which was consistent with the study of Park et al. (22). This issue can confirm the role of economic status of a person with depression. The average serum concentration of selenium in the case group was equal to 89.10 ± 32.21 $\mu\text{g/liter}$, which was lower than the average serum concentration of selenium in Ekramzadeh's study (23) and was higher than the average serum concentration of selenium in Conner et al.'s study (19). The average serum concentration of selenium in the control group was equal to 95.90 ± 36.03 $\mu\text{g/liter}$, which was lower than the average serum concentration of selenium in Ekramzadeh's study (20). The amount of serum concentration of selenium in the case group was lower than the control group and was consistent with the study of Ekramzadeh et al. (20). Although, there was observed no statistically significant difference between the case and control groups which this finding was similar with the study by Gao et al. (23). Also, these findings had not consistent with the study by Li (24), Pasco (21), and Sher et al. (25). Although, in the studies that had discrepancies, factors such as alcohol consumption had an effect on the amount of selenium, and the size of the studied population was also larger than the present study. Also, there was observed no statistically significant correlation between serum concentration of selenium and the Beck depression questionnaire score, which had inconsistent with the study by Banikazemi (18) and the study of Ibarra et al. (7).

Conclusion

Although, the role of selenium in depression has been discussed in some studies, but in this study, there was observed no convincing relationship despite its lower serum concentration in depressed people. In addition to more investigations and with a larger statistical population about this rare element of the body, it is possible to investigate other micronutrients, vitamins and other rare elements which has been implied to their role in some studies.

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