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The Relationship of Dietary Intake of Zinc, Selenium, and Magnesium and Anthropometric Profiles with Depression in Female Medical Students at Zahedan University of Medical Sciences

Shahrzad Shokati; MSc[1], Zahra Kavian; MSc*[1], Mansour Shahraki; PhD[1], Mona Afshari; MD[1]

[1] *Department of Nutrition, School of Medicine, Zahedan University of Medical Sciences, Zahedan, Iran.*

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***Corresponding author:**
Z_kaviyan@yahoo.com
Department of Nutrition, School of Medicine, Zahedan University of Medical Sciences, Zahedan, Iran.

Postal code: 9816745785
Tel: +989399869582

ABSTRACT

Background: Depression, as the second leading cause of dysfunction, is one of the most common mental health disorders. Given that micronutrients have always played a significant role in all physical and psychological aspects of individuals. This study was conducted to investigate the relationship of dietary intake of Selenium, Magnesium, Zinc, and anthropometric profiles with depression in female students at Zahedan University of Medical Science, Zahedan, Iran. **Methods:** In this cross-sectional study, 200 female medical students of Zahedan University of Medical Sciences participated. The amount of dietary intake of Selenium, Magnesium, and Zinc were measured by Food Frequency Questionnaire (FFQ). For determining the depression score, Beck anxiety questionnaire was administered. To analyze the data, SPSS 22 software was used. **Results:** The mean of age, body mass index, waist-to hip ratio and waist-to-height ratio were 23.41 ± 2.26 years, 23.54 ± 4.49 kg/m^2, 0.85 ± 0.08, and 0.59±0.10, respectively. The mean daily intake of Magnesium, Zinc, and Selenium were 196.37 ± 42.08 mg, 7.38 ± 3.41 mg, and 106.52 ± 31.69 mg, respectively. The mean of depression score was 31.21±10.58. Zinc and Magnesium intake had a significantly strong inverse relationship with depression score and anthropometric indices. **Conclusions:** The findings showed that Zinc and Magnesium intake as well as anthropometric indices had a significant inverse relationship with depression score. However, the association between Selenium intake and depression score was not significant.

Keywords: *Selenium; Magnesium; Zinc; Anthropometric profiles; Depression*

Introduction

Depression, a mood disorder, is a major global problem (Kraemer *et al.*, 2011). According to the World Health Organization (WHO), 350 million people worldwide suffer from depression and women are affected two times higher than men. A study in 2010 determined that depressive disorders cause 3.8% of the global Disability Adjusted Life Years (DALY). As a contributor to DALY, depression is expected to become the second most common concern among all ages by 2020 (Ferrari *et al.*, 2013). Depression, as one of the most common mental illnesses in the world, includes emotional, cognitive, and physical symptoms, leading to many individual, social, and

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economic consequences (Fernandes *et al.*, 2017, Fried *et al.*, 2017). Depression can also cause obesity indirectly through behaviors such as eating emotionally, eating caloric-dense foods, and decreased physical activity (Blaine, 2008). Furthermore, obesity leads to the development of depression over time through the negative effects on one's self-image or physical outcomes (Levenson, 2006).

Depression and obesity are widely associated with public health (Blaine, 2008). The effects of depression on chronic diseases, including high blood pressure and coronary heart disease were demonstrated by a large study conducted in 2000 (Schulz *et al.*, 2000)

A meta-analysis on more than 33,000 depressed and non-depressed people showed that depressed people were more likely to develop obesity than non-depressed ones. This general vulnerability has increased in female adolescents, so that development of obesity is 2.5 times more probable among depressed female teens than non-depressed ones (Blaine, 2008).

Depression is a multifactorial disorder including genetics and environmental factors such as diet and nutrition, which can play a role in its etiology and treatment (Fernandes *et al.*, 2017). Deficiency of micronutrients is a major global health problem so that more than two billion people suffer from vitamin and mineral deficiencies around the world (Sijbesma and Sheeran, 2011). Micronutrients are associated with health outcomes such as cognitive function, cancer, obesity, and immune system function (Ames, 2001, Asfaw, 2007, Black, 2003, García *et al.*, 2009, Jáuregui-Lobera, 2014, Kristal *et al.*, 2014, Shankar and Prasad, 1998, Wintergerst *et al.*, 2007). However, the role of micronutrients in the cause and progression of depression is still unclear (Wang *et al.*, 2018). Therefore, in addition to anthropometric indicators, the role of in taking Zinc, Selenium, and Magnesium in depression can also be examined. Clinical studies indicated that drug therapy in people with depression is more effective by using Zinc and Magnesium supplements (Levenson, 2006). Given that Zinc concentrations are reduced in clinical depression, measuring the concentration of Zinc in patients' blood was suggested as a useful clinical indicator for depression (Siwek *et al.*, 2013).

Another element effective in depression is Magnesium, which can play a role in preventing the transmission of synapses in tissues of the central nervous system (Wojtowicz *et al.*, 1977). Although Magnesium supplementation was associated with improved symptoms of depression, no consensus was observed on the association between Magnesium and depression (Tarleton and Littenberg, 2015). Magnesium intake was found insufficient in many Western countries (Eby III and Eby, 2010). Conditions such as malnutrition, alcohol consumption, and diuretics can also lead to Magnesium deficiency (Rasmussen *et al.*, 1990).

Different information is available with regard the role of Selenium in depression. Selenium plays an important role in brain function and dopamine modulation. Dopamine plays a pathophysiological role in depression and mental illness. Decreased levels of Selenium in the brain are associated with cognitive impairment and Alzheimer's disease. Low Selenium intake increases the risk of major depression. Consumption of Selenium-rich foods such as grains, liver, fish, eggs, etc., can provide 60 micrograms of Selenium per day. In general, these studies showed that a rich diet reduces the risk of depression and anxiety (Burk, 2002).

Since previous studies indicated that obesity and Zinc deficiency are effective in the process of depression, the present study aimed to investigate the relationship of Zinc, Selenium, and Magnesium intakes as well as anthropometric profiles with depression. The study was conducted among female medical students at Zahedan University of Medical Sciences, Zahedan, Iran.

Materials and Methods

Study design and participants: An analytical cross-sectional descriptive study was conducted to investigate the relationship of dietary intake of Zinc, Selenium, and Magnesium as well as anthropometric indicators with depression score on female medical students of Zahedan University of Medical Sciences in 2019. The participants were within the age range of 19-28 years. The inclusion criteria were being a female student studying at Zahedan University of Medical Sciences, providing oral consent and evaluating the criteria, and being within the age range of 18-29 years. The exclusion criteria included having liver disorders and megaloblastic anemia, using supplementations over the past six months, and not providing the informed consent forms. The sample size was determined as 200 people.

Measurements: In this study, the participants' intake of Zinc, Magnesium, and Selenium was measured using a 37-item Food Frequency questionnaire (FFQ) by N4 software. The 21-item Beck anxiety questionnaire was also administered to determine the participants' depression scores. In a previous study among Korean students, the standard cut-off scores were as follows: 0–9 indicated minimal depression, 10–15 indicated mild depression, 16–23 indicated moderate depression, and 24–63 indicated severe depression (Yook and Kim, 1997). The measurement of anthropometric indicators including height, weight, waist circumference (WC), and hip circumference was performed by a trained person. Later, body mass index (BMI) (weight in kilograms divided by height in meters squared), waist-to-height ratio (WHtR), and waist-to-hip ratio (WHpR) were calculated.

Data analysis: Data were analyzed using SPSS software version 22. Descriptive statistics including frequency, percentage, and standard deviation, independent t-test, chi-square test, and ANOVA were run for analysis of data. All reported probability (P-value) were two-sided using P-value < 0.05 as the statistically significant rate.

Ethical considerations: In this study, all ethical principles were observed in accordance with the general guidelines of ethics in medical sciences research with human participants in the Islamic Republic of Iran (codes 1-10-12-15-16-16-77-31).

Results

In total, 200 female medical students participated in this study. The mean age of the students was 26.23 ± 23.41 years. The mean BMI was 23.54 ± 4.49 kg/m^2. The mean WHpR and WHtR indices were 0.85 ± 0.08 and 0.59 ± 0.10, respectively. The mean depression score was 31.21 ± 10.58 (**Table 1**).

In studying the participants' obesity, 15% (n = 30) of students had a weight index less than ideal body weight, 48% (n = 96) had an ideal body weight index, 30.5% (n = 61) were overweight, and 5.6% (n = 13) were obese (**Table 2**).

In this study, the mean daily intake of magnesium, zinc, and selenium were 196.37 ± 42.08 mg, 7.38 ± 3.41 mg, and 106.52 ± 21.69 mg, respectively. The mean amount of zinc and magnesium consumption was lower than the recommended daily allowance (RDA) value (**Table 3**).

Statistical findings showed a significant direct relationship between anthropometric indices and depression scores (P <0.001) (**Table 4**).

The results of the logistic regression test showed an inverse relationship between daily dietary intake of Magnesium, Zinc, and Selenium (P <0.001). This association was more significant for zinc and Magnesium (**Table 6**).

Table 1. The mean age and anthropometric indicators in female medical students

Variables	Minimum	Maximum	Mean ± SD
Age (y)	18	29	23.41 ± 2.26
Body mass index (kg/m^2)	16.00	34.80	23.54 ± 4.49
Waist-to-hip ratio	0.58	1.30	0.85 ± 0.08
Waist-to-height ratio	0.37	0.80	0.59 ± 0.10
Depression score	6	58	31.21 ± 10.58

Table 2. Frequency distribution of participants according to weight status and body mass index classification.

Body mass index classifications (kg/m^2)	Weight status	N (%)
< 18.5	Underweight	30 (15)
18.5-24.9	Normal weight	96 (48)
25-29.9	Overweight	61 (30.5)
>30	Obese	13 (6.5)

Table 3. The mean daily intake of minerals in participants

Minerals	Mean ± SD (n=200)	Recommended daily allowance (RDA)
Magnesium (mg/day)	196.37 ± 42.08	310 - 400
Zinc (mg/day)	7.38 ± 3.41	8 - 11
Selenium (mg/day)	106.52 ± 21.69	55 - 70

Table 4. Association between depression score and anthropometric indices in participants

Anthropometric indices	P-value	r
Body mass index (kg/m^2)	<0.001	0.815
Waist-to-hip ratio	<0.001	0.696
Waist-to-height ratio	<0.001	0.750

Table 5. Comparison of mean of depression score according to body mass index classification and weight status.

Body mass index classifications (kg/m^2)	Weight status	Mean ± SD
< 18.5	Underweight	20.46 ± 6.29
18.5-24.9	Normal weight	25.81 ± 4.27
25-29.9	Overweight	40.24 ± 5.31
>30	Obese	53.46 ± 2.02

ANOVA test; p-value <0.001

Table 6. Correlation between daily intake of minerals with depression score

Minerals	P-value	r
Selenium (mg/day)	<0/001	−0.476
Magnesium (mg/day)	<0/001	−0.851
Zinc (mg/day)	<0/001	− 0.842

Discussion

We found that depression scores of participants were moderate. Anthropometric indices of the them were normal. A significant relationship was also found between depression and BMI. In the study by Tashakori in Ahwaz the relationship between BMI and depression was significantly correlated with students' depression score and BMI. Similar to our study, the researcher stated that this relationship was direct and significant

(Tashakori *et al.*, 2016). Furthermore, a study in 2009 showed a significant and direct relationship between BMI and depression in Amsterdam (De Wit *et al.*, 2009). A study by Hidese in Tokyo on the association of depression with the BMI and metabolic disorders classification among 11876 people showed that obese individuals had a higher depression score (Hidese *et al.*, 2018). In our study, a significant and direct relationship was found between indices of WC, WHtR, and depression score. In another study over BMI, WC, WHpR, and their association with depressive symptoms in Chinese women, a significant relationship was found between BMI and depression. Moreover, a higher rate of depression was observed in the population with increasing WC and increasing WHpR (Zhi *et al.*, 2017). In a study in Brazil, the relationship between depression, anthropometric parameters, and body image was conducted (Silva *et al.*, 2019). A study over the association between obesity and depression in Mexico conducted by Zavala *et al.* found a strong association between all anthropometric indicators and depression in women, but no association was found in men (Zavala *et al.*, 2018).

As it can be seen, most studies reported findings consistent with our study. The reason for this can be found in metabolic indicators such as leptin, which is observed in obese people. These metabolites can affect serotonin-dopamine levels and cause emotional symptoms.

In the present study, the nutrient intake of minerals such as Zinc, Magnesium, and Selenium showed a significant and inverse relationship with the rate of depression. In other words, the rate of depression was higher with the reduction of the above-mentioned minerals.

In a study on the role of Magnesium supplements and depression, it was reported that Magnesium intake during the two weeks of treatment had a significant effect on mild to moderate depression (Tarleton *et al.*, 2017). However, a meta-analysis over Magnesium and mood disorders indicated that some articles reported the effect of Magnesium on mood disorders (Phelan *et al.*, 2018).

Chan also studied the effect of Zinc, Magnesium, Selenium supplementation on depression and reported that a balanced diet, including adequate intake of foods containing Zinc and other micronutrients, was effective for depression and reduced the symptoms of this disorder (Chan *et al.*, 2016). Szewczyk also investigated the role of Magnesium and Zinc in depression and found that Zinc had a significant effect on depression, so that it was also prescribed in major depression. The study also found that magnesium affected depression (Szewczyk *et al.*, 2018). In a study by Hidese *et al.* on the relationship of Zinc, Iron, and Selenium intake with depression, it was reported that the chances of getting the recommended daily amounts of Zinc and Selenium were significantly lower (Hidese *et al.*, 2018).

Based on the findings, most of the present studies confirmed the association between received minerals and depression. This can be justified by the importance of antioxidants, as they are widely used in the removal of neurotransmitters, as well as metalloproteinase, which are known as effective carriers in the blood and tissues. As a result, disturbances in the intake of micronutrients can cause mood-neurological disorder.

Conclusion

This study showed that increase of some anthropometric indicators, such as BMI can incraese the rate of depression. The findings reveated that reducing the intake of Zinc and Magnesium can incraese the rate of depression. Therefore, it can be concluded that physical activity can lead to an ideal body weight and adequate intake of Zinc and Magnesium can be considered as preventive ways and thrapeutic factors to deal with some mood disorders like depression.

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Authors' contributions

Shokati S, Kavian Z, Shahraki M, Afshari M contributed to conception, design, data collection, statistical analyses, data interpretation, manuscript drafting, and approval of the final version of the manuscript and agreed for all aspects of the work.

Coflict of interest

The authors declared no conflict of interest.

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