RESEARCH

THE LINK BETWEEN DIETARY MINERAL INTAKE LEVELS AND DEPRESSION STATUS IN UNIVERSITY STUDENTS

Abstract

The objective of this study was to determine associations between dietarymineral intake levels and depression statusin university students. A cross-sectional study was conducted in 400university students, aged between 19-29 years, living in Cyprus."Beck Depression Inventory (BDI)" was used to determine the presence of depression."24-hour dietary recall" was taken and sufficiency of dietary mineral intake of individuals was evaluated according to the values of "Dietary Reference Intake (DRI)".Calcium (Ca) intake was found to be insufficient in the majority of severe (41.7%) depressed students. 38.6% of the students who were minimally depressed were receiving inadequate iron and 9.5% of them were receiving excess iron (Fe). Zinc (Zn) intake was mostly sufficient in all Beck classification groups. Magnesium (Mg) intake was insufficient in the majority of depressive students with minimal (64.6%), mild (53.5%), moderate (58.3%) and severe (58.3%) levels. Sodium (Na) was found to be insufficient in 7.0% of minimally depressed students,0.8% of mildly depressed students and 7.8% of intermediate depressed students. Depression is a common health problem in the university student populations. The findings were guiding in understanding the relationship between dietary mineral intake levels and depression status in university students and supportive of healthcare professionals.

Keywords: Calcium, Iron, Zinc, Magnesium, Sodium, Depression, University students

ARAŞTIRMA

ÜNİVERSİTE ÖĞRENCİLERİNDE DİYET MİNERAL ALIM DÜZEYLERİ İLE DEPRESYON DURUMLARI ARASINDAKİ İLİŞKİ

Özet

Bu çalışmanın amacı üniversite öğrencilerinin diyet mineral alım düzeyleri ile depresyon durumları arasındaki ilişkiyi saptamaktı. Bu kesitsel çalışma Kıbrıs'ta yaşayan 19-29 yaş arası 400 üniversite öğrencisi ile yürütüldü. Depresyon varlığını belirlemek için "Beck Depresyon Envanteri (BDI)" kullanıldı. "24 saatlik diyet hatırlaması" alındı ve bireylerin diyetle mineral alımı yeterliliği "Diyet Referans Alımı (DRI)" değerlerine göre değerlendirildi. Kalsiyum alımının şiddetli (%41.7) depresyon seviyesi olan öğrenciler çoğunluğunda yetersiz olduğu saptandı. Minimal düzeyde depresyona sahip olanlarda %38.6'sı yetersiz ve %9.5'i aşırı demir almaktaydı. Çinko alımı tüm beck sınıflaması gruplarında çoğunlukla yeterliydi. Magnezyum alımı minimal (%64.6), hafif (%53.5), orta (%58.3) ve şiddetli (%58.3) düzeyde depresyona sahip olanların çoğunluğunda yetersizdi. Sodyumun, minimal düzey depresif öğrencilerin %7.0'ında, hafif depresyon seviyesi olan öğrencilerin %0.8'inde ve orta düzey depresiflerin ise %7.8'inde yetersiz alındığı saptandı. Depresyon üniversite öğrenci popülasyonlarında sık karşılaşılan bir sağlık sorunudur. Bulgular, üniversite öğrencilerinde diyet mineral alım düzeyleri ile depresyon durumu arasındaki ilişkinin anlaşılmasında yol gösterici ve sağlık personellerine destek olucu olmıştur.

Anahtar Kelimeler: Kalsiyum, Demir, Çinko, Magnezyum, Sodyum, Depresyon, Üniversite Öğrencileri

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Baygut H, Yücecan S. The Link Between Dietary Mineral Intake Levels And Depression Status In University Students. Haliç Üniv Sağ Bil Der. 2020;3(3) 161-168

Baygut H, Yücecan S. Üniversite Öğrencilerinde Diyet Mineral Alım Düzeyleri İle Depresyon Durumları Arasındaki İlişki. Halic Uni J Health Sci, 2020;3(3) 161-168

Geliş Tarihi: 02.07.2020
Kabul Tarihi: 17.09.2020

1. Introduction

The mood that has been defined systematically for the first time in history is melancholy. Hippocrates, by defining melancholy as "blackening of the soul with black bile affecting the brain", also pointed out that the mood is related to the biochemistry of the brain (1).Depression is also a mood disorder. Decreased interest in the world, lost capacity to invest or connect with other people, serious self-esteem are/found in the diagnosis of depression along with feelings such as self-blame, condemnation, self-reproach, self-insultand contempt (2,3).

According to the data of the World Health Organization (WHO), it has been reported that the frequency of depression in the society exceeded 18% between 2005 and 2015, and today three hundred million people struggle with depression (4).In the world, one in five women and one in ten men suffer from depressive disorders at any time in their life (5).According to the WHO, depression is estimated to be the disease that most affects the world population in 2030 (6,7). Depressive disorders, anxiety disorders, and eating disorders are more common in university students than in general population and are seen in high rates (8,9).

The etiology and pathophysiology of depression is associated with many different factors including psychological stress (10), immune activation (11), changes in endogenous opioids (12), genetic factors (13), oxidative and nitrosative stress (14) and changes in minerals, elements and anti-oxidants (15).

Adequate and balanced nutrition is required for the continuity of brain functions (16). The most frequently investigated minerals in the literature are: calcium, iron, zinc, magnesium, lithium, copper, chromium, manganese(17,18,19). Sodium, potassium and other electrolytes are known to increase the arousal of nerve cells(20).

Although there are many studies on dietary mineral intake and depression level especially in adults, it is noteworthy that there is not much researchabout university students. Therefore, this study examined associations between dietary mineral intake levels and depression status in university population.

2. Material and Method

Study population

This cross-sectional study was conducted in students, aged 18-29 years, living in Cyprus. It was carried out with 400 (193 male and 207 female) students selected by the "Stratified Random Sampling Method" registered in Near East University between September 2012 and December 2012. After obtaining approval from each participant, the consent form was read and signed. Study data was generated via a questionnaire, using face to face interviews. Ethical approval was obtained fromthe Near East University Ethics Revıew Booard of Health Sciences Ethics Comitteewith the number of YDU/2012/10-59.

Assessment of depression status

"Beck Depression Inventory (BDI)" was used to determine the presence of depression. BDI was developed by Beck et al. to measure the behavioral findings of depression in adolescents and adults in 1961 (21). It was translated into Turkish and its validity and reliability study was carried out by Hisli (22). In the scale, depression-specific behaviors and symptoms are defined by a series of sentences, and each sentence is numbered from 0 to 3.The scale consists of twenty one items which are sorted from light form to severe form. The score that can be obtained varies between 0 and 63 (0=Positive statements about depression, 3=Shows negative statements about depression). As violence, It is interpreted as "0-9=minimal", "10-16=mild", "17-29=medium", "30-63=severe"(23).

Dietary mineral intake and DRI

In the study, food consumption record was taken using "24-hour dietary recall"method (24). The amounts consumed for the food consumption registration form were determined using the "Food and Nutrition Photo Catalog" (25) and the dietary mineral intake amounts were analyzed using the "BEBIS 6.0" version (26).

The sufficiency of dietary mineral intake of individuals was evaluated according to DRI values includingthe content of which is the same"-Recommended Daily Energy and Nutrient Levels

for Turkey Reliable Exchange", "Adequate Intake(AI)", "Estimate Average Intake(EAR)", "Recommended Dietary Allowance(RDA)" and "Tolerable Upper Intake Level (UL)" (27,28).Daily intake levels suggested as cut-off points [(2/3=67.0%~70.0%)±33.0%] were calculated andin this evaluation, individuals' dietary mineral intake was classified as "insufficient=<67.0%", "sufficient=67.0%-133.0%", "excess=>133.0%"according to the cut-off point.

2.1. Statistical Analyses

Qualitative data obtained or quantitative data converted into qualitative data were specified as numbers and percentages. Oneway ANOVA tests were used to compare the data on the qualitative variables between the variables indicated by the measurement. Analyses were performed using SPSS software for Windows (Statistical Package for Social Sciences, version 15.0, Chicago, IL, USA). $p<0.001$ was taken as the statistical significance level.

3. Results

Students participating in the study, 48.3% (193) were male and 51.7% (207) were girls. 39.5% of the students were minimal, 31.9% were mild, 25.3% were moderate and 3.3% were severely depressed. In table 1, the adequacy level of the dietary mineral intake status according to the Beck Score Classification of the Individuals is shown according to DRI. Calcium intake was found to be insufficient in the majority of depressive students with minimal (64.6%), mild (67.7%), moderate (68.9%) and severe (41.7%) levels. The percentages of those who received excessive calcium in the students were 1.3% of minimally depressed students, 0.8% of mild depressed students, and 1.0% of mild depressed students.None of the severely depressed students had excessive calcium intake. 38.6% of the students who were minimally depressed were receiving inadequate iron and 9.5% of them were receiving excess iron. These values were 33.9% and 11.0%, 47.6% and 13.6%, 83.3% and 16.7%, respectively, in mild, moderate and severe depressive students. Zinc intake was mostly sufficient in all beck classification groups.29.7% of minimally depressed students, 12.6% of mild depressed students, 17.5% of intermediate depressed students, and 16.7% of severe depressed students received inadequate zinc. Magnesium intake was insufficient in the majority of depressive students with minimal (64.6%), mild (53.5%), moderate (58.3%) and severe (58.3%) levels. Sodium was found to be insufficient in 7.0% of minimally depressed students, 0.8% of mildly depressed students and 7.8% of intermediate depressed students.

Table 1: Adequacy level of individuals' daily energy and nutrient consumption according to Beck Score Classification according to DRI

Minerals		Calcium				Iron				Zinc				Magnesium				Sodium			
Beck Score	**Level of DRI**	**n**	**%**	**p_1**	**p_2**	**n**	**%**	**p_1**	**p_2**	**n**	**%**	**p_1**	**p_2**	**n**	**%**	**p_1**	**p_2**	**n**	**%**	**p_1**	**p_2**
0-9	**1**	102	64.6			61	38.6			47	29.7			102	64.6			58	36.7		
	2	54	34.2	**0.000**		82	51.9	**0.000**		92	58.2	**0.000**		52	32.9	**0.000**		65	41.1	**0.000**	
	3	2	1.3			15	9.5			19	12.0			4	2.5			35	22.2		
	Total	**158**	**100.0**			**158**	**100.0**			**158**	**100.0**			**158**	**100.0**			**158**	**100.0**		
10-16	**1**	86	67.7			43	33.9			16	12.6			68	53.5			56	44.1		
	2	40	31.5	**0.000**		70	55.1	**0.000**		81	63.8	**0.000**		55	43.3	**0.000**		57	44.9	**0.000**	
	3	1	0.8			14	11.0			30	23.6			4	3.1			14	11.0		
	Total	**127**	**100.0**			**127**	**100.0**			**127**	**100.0**			**127**	**100.0**			**127**	**100.0**		
17-29	**1**	71	68.9		**0.000**	49	47.6		**0.000**	18	17.5		**0.000**	60	58.3		**0.000**	35	34.0		**0.000**
	2	31	30.1	**0.000**		40	38.8	**0.000**		69	67.0	**0.000**		39	37.9	**0.000**		46	44.7	**0.000**	
	3	1	1.0			14	13.6			16	15.5			4	3.9			22	21.4		
	Total	**103**	**100.0**			**103**	**100.0**			**103**	**100.0**			**103**	**100.0**			**103**	**100.0**		
30-63	**1**	5	41.7			10	83.3			2	16.7	**0.000**		7	58.3			2	16.7		
	2	7	58.3	**0.000**		2	16.7	**0.000**		8	66.7			4	33.3	**0.000**		4	33.3	**0.000**	
	3	-	-			-	-			2	16.7			1	8.3			6	50.0		
	Total	**12**	**100.0**			**12**	**100.0**			**12**	**100.0**			**12**	**100.0**			**12**	**100.0**		

Oneway ANOVA, * $p<0.001$

4. Discussion

Unhealthy diet can be a risk factor for depression. The intake of minerals at recommended levels can be a protective factor for depression.

Depression is associated with conditions that are characterized by changes in Ca homeostasis including lowered vitamin D (29).In this study, calcium intake was found to be insufficient in the majority of depressive students with minimal (64.6%), mild (67.7%), moderate (68.9%) and severe (41.7%) levels. None of the severely depressed students had excessive calcium intake. In a study, among university student teenage girls with an average age of 21.4±3.6, the effectiveness of calcium supplementation was investigated in some of the disorders seen before the menstrual period andsignificant decreases in depression were observed in calcium areas compared to the placebo group (30). In another study, 65 depressive and 65 healthy controls were compared and found that dietary calcium intake was low but not significant in the depression group compared to the control group (31).There may be a significant inverse relationship between consumption of milk and dairy products, which are sources of calcium and vitamin D, and depression.

Iron is important in regulating cellular function and neuromodulation (32). In our study, 38.6% of the students who were minimally depressed were receiving inadequate iron and 9.5% were receiving excess iron. These values were 33.9% and 11.0%, 47.6% and 13.6%, 83.3% and 16.7%, respectively, in mild, moderate and severe depressive students. For dietary iron intake, while a significant association with a decreased risk of depression was reported in two studies (33,34), the significant association was not found in one study (35). Symptoms of depression, such as irritability, indifference and difficulty in concentration can be caused by iron deficiency.

After iron, it is the most concentrated metal zinc in the brain and is found in the synaptic vesicles, where specific neurons are modulated and act like a neurotransmitter. Zinc plays a role in the functionality and stress responses of zinc-related enzymes. Zinc regulates 5-HT and NE content of the brain by inhibiting MAO-A activity (36,37,38). In our study, zinc intake was mostly sufficient in all beck classification groups.29.7% of minimally depressed students, 12.6% of mild depressed students, 17.5% of moderate depressed students, and 16.7% of severe depressed students were found to have inadequate zinc. In a study, 23 depressed and 23 healthy university female students, depressed students' consumption of red meat and chicken meat as a zinc source was found to be significantly lower compared to the control group, while there was no difference between dietary intake of other zinc sources (39). In a study by Gonoodi et al. (40) in adolescent girls, while a negative relationship was shown between dietary zinc intake and depressive symptoms, they did not find any relationship between serum zinc level and severity of depression. Low zincand decreased appetite may be a result of depression due to reduced dietary intake or immune/inflammatory response in depression.

Mg deficiency increases the risk of depression and is often accompanied by a variety of depressive symptoms (41,42).It is known that magnesium can play a key role in the pathological pathways of depression due to its presence in many enzymes, hormones and neurotransmitters (43). In our study, magnesium intake was insufficient in the majority of depressive students with minimal (64.6%), mild (53.5%), moderate (58.3%) and severe (58.3%) levels. However, the results of these studies are controversial. Dietary Mg intake were found to be significantly associated with a decreased risk of depression in some studies (34,43,44,45), while Yary, Sharkey, Jacka and Derom found no associations between dietary Mg and Ca intake and risk of depression (46,47,48,49). The neuroprotective property of magnesium can explain its inverse relationship in major depression.

It is an important cation found in sodium extracellular body fluid and an electrolyte necessary for nerve conduction (50).In our study, it was found that sodium was insufficient in 7.0% of minimally depressed students, 0.8% of mild depressive students and 7.8% of intermediate depressed students. In a study by Bradley et al. (51), a significant relationship was found between depression and excessive sodium consumption. In an other study, an interaction of depression and gender also explains dietary

sodium intake because of a negative relationship of depression and dietary sodium in women ($p<0.05$), but not men (52).The possibility that salt intake protects against stress is an enduring hypothesis derivenfrom the commonality of adrenal corticoids mediating salt appetite and stress, and the intertwining reninangiotensin aldosterone system (RAAS) regulating sodium appetite, sodium concentration, fluid volume, and sympathetic tone including blood pressure and depression.

4.1. Limitations

Since our study is a cross-sectional society study, depression diagnosis was made by using an inventory. The results are not possible to generalize for the whole society without medical diagnosis. However, in clinical studies with large samples, individuals who are depressive according to the results of this study can be re-evaluated with medical methods.

5. Conclusions

This study provides further evidence in support of a significant inverse association between dietary mineral intake and risk of depression.

Disclosure statement

No potential conflict of interest was reported by the authors.

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