GEVHER NESIBE JOURNAL OF MEDICAL & HEALTH SCIENCES | ISSN 2717-7394

Arrival Date: 12.12.2021 | **Published Date:** 31.01.2023 | **Vol:** 8, **Issue:** 1 | **pp:** 190-201 | **Doi Number:** http://doi.org/10.5281/zenodo.7601520

THE RELATIONSHIP OF DIETARY NUTRIENTS WITH DEPRESSION, ANXIETY AND STRESS: A SAMPLE OF NUTRITION AND DIETETICS STUDENTS

BESİN ÖGELERİ İLE DEPRESYON, ANKSİYETE VE STRES İLİŞKİSİ: BESLENME VE DİYETETİK ÖĞRENCİLERİ ÖRNEĞİ

Pınar HAMURCU [1]

[1] Istanbul Kent University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Istanbul, Turkey.

ABSTRACT

Aim: The aim of this study is to examine the relationship between dietary nutrients intake according to Dietary Reference Intakes (DRI) recommendations and depression, anxiety and stress levels of nutrition and dietetics students.

Method: The cross-sectional descriptive study was conducted at Uskudar University in the 2019-2020 academic year, voluntarily, questioning demographic characteristics, "Depression, Anxiety and Stress Scale (DASS-42)" and "3-Day Food Consumption Record Form" were applied face-to-face interview method. IBM SPSS v26® software was used in the analysis of the data.

Results: A total of 251 undergraduate students, whose 94.4% was female participated in the study. The mean age of the participants was 20.63±1.51 years, and the mean Body Mass Index (BMI) was 21.36±3.11 kg/m2. Anxiety levels of students whose daily vitamin B-2 intake were below the DRI and depression levels of students whose daily vitamin C intake were above the DRI were statistically significantly higher ($p<0.05$). Depression, anxiety and stress levels of students whose daily dietary carbohydrate intake, vitamin B-1, biotin, folic acid and phosphorus, iodine, selenium were above the DRI and whose daily dietary protein intake, percentage of total energy from fat, daily dietary omega-3, vitamins A, E, K, B-5 and calcium, zinc, manganese intakes were below the DRI were higher, but they were not statistically significant. ($p>0.05$).

Conclusions: The deficiency or excess of some nutrients according to DRI was correlated with some mood disorders.

Keywords: Anxiety, Depression, Mood Disorders, Nutrients, Nutritional Status.

ÖZET

Amaç: Bu çalışmada, Beslenme ve Diyetetik Bölümü öğrencilerinin Diyet Referans Alımları (DRI) önerilerine göre besin öğeleri alımları ile depresyon, anksiyete ve stres düzeyleri arasındaki ilişkiyi incelemek amaçlanmıştır.

Yöntem: Kesitsel tanımlayıcı tipteki çalışmada veriler, 2019-2020 akademik yılında Üsküdar Üniversitesi'nde, gönüllülük esasına dayalı olarak, katılımcıların demografik özelliklerini sorgulayan Bilgi Formu, Depresyon, Anksiyete ve Stres Ölçeği (DASS-42) ve 3 Günlük Besin Tüketim Kayıt Formu'nun yüz yüze görüşme yöntemi uygulanarak elde edilmiştir. Verilerin analizinde IBM SPSS v26® yazılımı kullanılmıştır.

Bulgular: Çalışmaya %94,4'ü kadın olmak üzere toplam 251 lisans öğrencisi katılmıştır. Katılımcıların yaş ortalaması 20,63±1,51 yıl, BKİ (beden kütle indeksi) ortalaması 21,36±3,11kg/m2'dir. Yaşa ve cinsiyete göre DRI önerileri doğrultusunda günlük yetersiz B-2 vitamini alanların anksiyete ve yetersiz C vitamini alanların depresyon puan ortalamalarının anlamlı yüksek olduğu saptanmıştır ($p<0.05$). Günlük diyet karbonhidrat alımı, B-1 vitamini, biyotin, folik asit ve fosfor, iyot, selenyum alımları DRI önerilerinin üzerinde olan ve günlük diyet protein alımı, toplam enerjinin yağdan gelen yüzdesi, günlük diyet omega-3, A, E, K, B-5 vitaminleri ve kalsiyum, çinko, manganez alımları DRI önerilerinin altında olan öğrencilerin depresyon, anksiyete ve stres düzeyleri daha yüksektir, ancak istatistiksel olarak anlamlı değildir ($p>0.05$).

Sonuç: DRI önerilerine göre bazı besin ögelerinin eksikliği veya fazlalığı bazı duygudurum bozuklukları ile ilişkilidir.

Anahtar kelimeler: Anksiyete, Beslenme Durumu, Depresyon, Gıdalar, Mizaç Bozuklukları.

Sorumlu Yazar / Corresponding Author: Pınar Hamurcu, Istanbul Kent University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Istanbul, Turkey. E-mail: pinarham@gmail.com

Bu makaleye atıf yapmak için / Cite this article: Hamurcu P. (2023). The Relationship of Dietary Nutrients with Depression, Anxiety and Stress: A Sample of Nutrition and Dietetics Students. *Gevher Nesibe Journal of Medical & Health Sciences*, 8(1), 190-201. http://doi.org/10.5281/zenodo.7601520

INTRODUCTION

The university period, in which, major changes affect the lives of individuals was experienced, which is also considered as the transition from childhood to adulthood, and mood disorders such as depression, anxiety and stress may occur during this period due to some issues such like, leaving the family home, exam and course processes such as finals, mid-terms, etc., and self-admitting to the new environment.[1] Mood disorders can affect individuals physically, emotionally, mentally, and socially, it also affects individuals' food selection and eating behaviors.[2] Studies show that some macro and micronutrients are effective in the treatment of mood disorders, in addition to traditional techniques such as pharmacotherapy and antidepressant usage.[3-6] Adequate amount of nutrition is required for the optimal functioning of the body, for healthy growth of the organism, for the continuity of brain functions, and for maintaining homeostatic mechanisms.[7]

A vicious cycle like depression and stress causing malnutrition, and malnutrition causing depression and stress may occur in the human body.[8] For instance, tryptophan, one of the amino acids essential for our body, is not synthesized in our bodies and it is transformed into 5-hydroxytryptamine (serotonin). The presence of serotonin, which is known as the happiness hormone in the brain, depends on tryptophan. Reduced levels of tryptophan, result in decreased levels of serotonin.[9] Individuals with decreased serotonin levels may suffer from depression. Serotonin deficiency in women can lead to depression and anxiety, whereas low levels of serotonin in men may lead to aggression and alcoholism.[10] Digesting complex carbohydrates-whole grains, vegetables and fruits increases the level of serotonin in the brain. In a study conducted with young adults, it was observed that a diet rich in carbohydrate content makes people feel calmer, happier, and more energetic.[11] Lipids are essential for the development of nerve cells in the brain. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are omega-3 polyunsaturated fatty acids (PUFAs) that are essential for the formation, maintenance, and the operation of the nervous system, as well as the synaptic transmission of neurotransmitters like serotonin and dopamine. Lack of these nutrients result in depression and anxiety-related behaviors.[12-14] Some vitamins and minerals such as group B vitamins (B-1, B-6, B-9, B-12), PUFA, vitamin D, zinc, magnesium, and calcium are inversely related to the symptoms which are associated with depression, stress and anxiety.[15]

Being able to adopt healthy lifestyle choices, which are necessary for living in a healthy society could avoid many diseases, such as obesity, diabetes, and hypertension. This research is important in terms of contributing to the reduction of social burden by lowering individual health expenditures in this approach. It is also critical in terms of assisting countries's health policies in implementing action plans and policies aimed at battling obesity and developing psychologically healthy young generations. The purpose of this research is to examine the relationship between dietary nutrients intake according to DRI recommendations and depression, anxiety and stress levels among nutrition and dietetics students.

MATERIALS AND METHODS

Study design and patients

This was a descriptive cross-sectional study. In the 2019-2020 academic year, target population of the study was 307 students from 1st, 2nd, 3rd, and 4th grades of Uskudar University's Faculty of Health Sciences' Department of Nutrition and Dietetics and 251 students participated in this study. The experiment took place after obtaining 'Ethics Committee Approval', numbered 61351342/2019-681 and dated 27.12.2019 from Non-Interventional Research Ethics Committee of Uskudar University. The research was based on voluntary surveys which acquired information such as demographic characteristics (age, gender, anthropometric measurements, sleep duration etc.); Depression, Anxiety and Stress Scale (DASS-42) and 3-Day Food Consumption Record Form which was taken by a dietitian via face-to-face interviews between January-February 2020.

Depression, Anxiety and Stress Inventory (DASS-42)

DASS which included 42-items, was created by Lovibond and Lovibond in 1995, and its validity and reliability examinations were carried out by Akın and Çetin in 2007. It is a 4-point Likert-type scale consisting of 42 items, 14 of which belong to depression, 14 to anxiety, and 14 to stress sub-dimensions. For depression the range of 0-9 is labeled normal, the range of 10-13 is mild, the range of 14-20 is moderate, the range of 21-27 is severe and 28+ is extreme severe depression; for anxiety the range of 0-7 is labeled normal, 8-9 is mild, 10-14 is moderate, 15-19 is severe, and 20+ is extreme severe; for stress the range of 0-14 is labeled normal, the range 15-18 is mild, the range 19-25 is moderate, the range 26-33 is severe, and the range 34+ is extreme severe stress.[1]

Food Consumption Registration Form

Participants were asked to record all the food and beverages they consumed in the last 3 days (2 weekdays-1 day on weekends) on the '3-Day Food Consumption Record Form'. The obtained data were analyzed with Nutrition Information Systems BeBiS 8.2. BeBiS is a data bank containing information about more than 20,000 foods, and it is a computer program capable of calculating the nutritional values of foods, recipes and diet plans created with more than 130 nutrient analyses.[17] The 'Nutrient Recommendations: Dietary Reference Intakes' is based on the adequacy of the calculated energy and values of macro, and micronutrients according to age and gender.[18]

Body Mass Index (BMI) rating

The body weight and height of the participants were measured by the researchers. Body weights of students were measured by Tefal 1063 Premiss brand (accurate up to 100 g, 150 kg maximum capacity) scales and their heights were measured by Frankfurt plane (eyes and auricles are at the same level and the angle between head and neck is 90 degrees) with a rigid tape measure fixed to the wall without shoes and feet put together.[19] Students' BMI values were calculated (body weight (kg)/height (m)^2 squared (kg/m^2)) and classified according to WHO's BMI classification.[20]

Statistical Analysis

IBM SPSS v26® was used in the analysis of the data; frequency distribution and percentages were used in descriptive statistics of qualitative data and mean and standard deviations were used in descriptive statistics of quantitative data. Independent Sample T Test was used for the comparison of nutrients between two independent groups. The significance value was determined as $p<0.05$.

RESULTS

A total of, 237 female (94.4%) and 14 male (5.6%) students participated in the study. The mean age of the students was 20.63±1.51 years, and the mean BMI value was 21.36±3.11 kg/m^2. In the study, 40.6% of the participants were 1st grade, 17.1% were 2nd grade, 25.9% were 3rd grade and 16.4% were 4th grade students. 65.4% of the students lived in their family/relative house. In addition, 15.1% of the students had diseases diagnosed by physicians, and the most common disease was allergies with 15.8%. According to the DASS-42 evaluation, “severe” and “very severe” depression prevalence was 15.2%, anxiety prevalence was 21.6% and the stress prevalence was 4.8% (Table 1).

Table 1. Demographic characteristics of the students and findings related to the DASS-42 evaluation

Gender	**n**	**%**
Female	237	94.4
Male	14	5.6
Age ($\bar{X} \pm SS$)	20.63±1.51	
BMI ($\bar{X} \pm SS$)	21.36±3.11	
Underweight (<18.5 kg/m^2)	41	16.3
Normal range (18.5-24.9 kg/m^2)	180	71.7
Overweight (25.0-29.9 kg/m^2)	24	9.6
Obese (≥30 kg/m^2)	6	2.4
Nutrition and Dietetic Class		
1st Class	102	40.6
2nd Class	43	17.1
3rd Class	65	25.9
4th Class	41	16.4
Place of residence		
Family/relative house	164	65.4
Student house	40	15.9
Dorm	47	18.7
Diagnosed disease status		
Yes	38	15.1
No	213	84.9

DASS-42 Evaluation		
Depression Level		
Normal	81	32.2
Mild	66	26.3
Moderate	66	26.3
Severe	29	11.6
Extreme Severe	9	3.6
Anxiety Level		
Normal	111	44.2
Mild	31	12.3
Moderate	55	21.9
Severe	27	10.8
Extreme Severe	27	10.8
Stress Level		
Normal	180	71.7
Mild	38	15.1
Moderate	21	8.4
Severe	10	4.0
Extreme Severe	2	0.8

Depression, anxiety and stress levels of students whose daily dietary carbohydrate (g) intake was above the DRI recommendations were higher, but these were not statistically significant (p>0.05). Students whose daily dietary protein (g) intake and percentage of total energy from fat (%) were below the DRI recommendations were found to have higher depression, anxiety and stress levels, but these were not statistically significant (p>0.05) (Table 2).

Table 2. Evaluation of students' macronutrient intakes with depression, anxiety, and stress levels according to DRI recommendations

			Depression		**Anxiety**		**Stress**	
		%	$\bar{X} \pm sd$	**t – p**	$\bar{X} \pm sd$	**t – p**	$\bar{X} \pm sd$	**t – p**
Carbohydrate (g)	Below	62.9	9.30±8.01	t=-1.356	9.00±5.75	t=-1.109	14.48±7.45	t=-1.711
	Above	37.1	10.73±8.13	p=0.176	9.88±6.62	p=0.268	16.14±7.36	p=0.088
Carbohydrate (%)	Below	64.1	9.76±8.01	t=-0.180	9.54±6.21	t=0.743	14.93±7.66	t=-0.484
	Above	35.9	9.96±8.21	p=0.857	8.94±5.88	p=0.458	15.40±7.08	p=0.629
Protein (g)	Below	51.4	10.26±8.61	t=0.870	9.71±6.14	t=1.014	15.42±7.47	t=0.706
	Above	48.6	9.38±7.46	p=0.385	8.93±6.02	p=0.312	14.75±7.43	p=0.481
Protein (%)	Below	0.4	5.00±0.00	t=-0.599	10.00±0.00	t=0.111	14.00±0.00	t=-0.147
	Above	99.6	9.85±8.08	p=0.549	9.32±6.10	p=0.912	15.10±7.46	p=0.883
Fat (%)	Below	16.7	11.31±8.42	t=1.302	10.36±6.31	t=1.204	16.86±7.33	t=1.687
	Above	83.3	9.54±7.98	p=0.194	9.12±6.03	p=0.230	14.74±7.43	p=0.093
Omega-3 (g)	Below	96.6	9.87±8.06	t=1.097	9.35±6.08	t=1.042	15.08±7.45	t=-0.525
	Above	3.4	1.00±0.00	p=0.273	3.00±0.00	p=0.298	9.00±0.00	p=0.600
Omega-6 (g)	Below	-	-	-	-	-	-	-
	Above	100.0	9.83±8.07	-	9.33±6.09	-	15.10±7.44	-
Fiber (g)	Below	88.4	9.89±8.10	t=0.297	9.37±6.21	t=0.307	14.87±7.51	t=-1.308
	Above	11.6	9.41±7.92	p=0.767	9.00±5.11	p=0.759	16.79±6.76	p=0.192

†t: Independent Sample T-Test. *:<0.05

The level of anxiety of students whose daily Vitamin B-2 intake were below the DRI recommendation and the level of depression of the students whose daily Vitamin C intake were above the DRI recommendation were statistically significantly higher ($p<0.05$). The levels of depression, anxiety and stress were higher in students whose daily dietary intakes of Vitamin A, Vitamin E, Vitamin K and Vitamin B-5 were below the DRI recommendations, but these were not statistically significant ($p>0.05$). Students whose daily dietary intakes of Vitamin B-1, biotin and folic acid were above the DRI recommendations were found to have higher depression, anxiety and stress levels, but these were not statistically significant ($p>0.05$) (Table 3).

Table 3. Evaluation of students' vitamin intake with depression. anxiety. and stress levels according to DRI recommendations

			Depression		**Anxiety**		**Stress**	
		%	$\bar{X} \pm sd$	**t – p**	$\bar{X} \pm sd$	**t – p**	$\bar{X} \pm sd$	**t – p**
Vitamin A (µg)	Below	63.3	9.96±8.34	t=0.334	9.77±6.55	t=1.636	15.28±7.82	t=0.506
	Above	36.7	9.61±7.61	p=0.739	8.55±5.12	p=0.103	14.78±6.78	p=0.613
Vitamin E (mg)	Below	95.6	10.80±7.97	t=-0.261	9.34±6.15	t=0.131	15.13±7.54	t=0.333
	Above	4.4	10.45±10.48	p=0.794	9.09±4.78	p=0.896	14.36±5.26	p=0.739
Vitamin K (µg)	Below	64.9	10.08±8.46	t=0.689	9.66±6.44	t=1.236	15.29±7.59	t=0.575
	Above	35.1	9.38±7.30	p=0.491	8.72±5.34	p=0.218	14.73±7.20	p=0.566
Vitamin B1 (mg)	Below	90.8	8.82±8.14	t=-0.077	9.32±6.16	t=-0.017	15.03±7.52	t=-0.434
	Above	9.2	9.96±7.51	p=0.939	9.35±5.38	p=0.986	15.74±6.75	p=0.664
Vitamin B2 (mg)	Below	56.2	10.00±8.26	t=0.371	10.11±6.33	**t=2.318**	15.86±8.08	t=1.898
	Above	43.8	9.62±7.85	p=0.711	8.33±5.63	**p=0.019***	14.12±6.44	p=0.059
Vitamin B3 (mg)	Below	88.0	9.83±7.98	t=-0.025	9.37±6.27	t=0.281	15.11±7.63	t=0.075
	Above	12.0	9.87±8.83	p=0.980	9.03±4.58	p=0.779	15.00±5.96	p=0.940
Vitamin B5 (mg)	Below	93.6	9.99±8.23	t=1.196	9.46±6.14	t=1.285	15.13±7.47	t=0.261
	Above	6.4	7.50±4.79	p=0.233	7.44±4.95	p=0.200	14.63±7.28	p=0.794
Vitamin B6 (mg)	Below	89.6	9.82±8.12	t=-0.086	9.36±6.22	t=0.255	15.23±7.56	t=0.848
	Above	10.4	9.96±7.77	p=0.932	9.04±4.80	p=0.799	13.92±6.32	p=0.397
Biotin / Vit B7 (µg)	Below	38.6	9.79±8.19	t=-0.060	9.27±5.93	t=-0.121	15.09±8.06	t=-0.005
	Above	61.4	9.86±8.02	p=0.952	9.36±6.20	p=0.904	15.10±7.06	p=0.996
Folic Acid / Vit B9 (µg)	Below	96.8	9.72±7.90	t=-0.796	9.32±6.12	t=-0.141	15.02±7.44	t=-0.831
	Above	3.2	13.25±12.46	p=0.452	9.63±5.15	p=0.888	17.25±7.59	p=0.407
Vitamin B12 (µg)	Below	41.8	9.10±7.40	t=-1.229	9.30±5.42	t=-0.050	15.22±6.84	t=0.222
	Above	58.2	10.36±8.50	p=0.220	9.34±6.54	p=0.960	15.01±7.87	p=0.824
Vitamin C (mg)	Below	65.3	10.77±8.54	**t=2.751**	9.86±6.41	t=1.916	15.73±7.70	t=1.850
	Above	34.7	8.06±6.80	**p=0.006***	8.32±5.31	p=0.057	13.91±6.83	p=0.066

‡t: Independent Sample T-Test. *:<0.05

Depression, anxiety and stress levels of students whose daily dietary calcium, zinc and manganese intakes were below the DRI recommendations were higher, but these were not statistically significant ($p>0.05$). The levels of depression, anxiety and stress were higher in students whose daily dietary intakes of phosphorus, iodine and selenium were above the DRI recommendations, but these were not statistically significant ($p>0.05$) (Table 4).

Table 4. Evaluation of students' mineral intakes with depression. anxiety and stress levels according to DRI recommendations

			Depression		**Anxiety**		**Stress**	
		%	$\bar{X} \pm sd$	**t – p**	$\bar{X} \pm sd$	**t – p**	$\bar{X} \pm sd$	**t – p**
Sodium (mg)	Below	25.5	10.34±9.33	t=0.531	9.52±6.69	t=0.287	14.83±8.19	t=-0.332
	Above	74.5	9.66±7.61	p=0.597	9.26±5.88	p=0.774	15.19±7.19	p=0.740
Calcium (mg)	Below	94.8	9.88±8.08	t=0.417	9.41±6.09	t=0.901	15.10±7.48	t=0.009
	Above	5.2	8.92±8.06	p=0.677	7.85±6.14	p=0.369	15.08±7.09	p=0.993
Magnesium (mg)	Below	91.2	9.84±8.11	t=0.036	9.31±6.14	t=-0.140	14.98±7.49	t=-0.776
	Above	8.8	9.77±7.75	p=0.971	9.50±5.60	p=0.889	16.27±7.00	p=0.439
Phosphorus (mg)	Below	33.9	9.60±7.86	t=-0.326	9.24±5.80	t=-0.170	14.46±7.47	t=-0.970
	Above	66.1	9.95±8.19	p=0.744	9.37±6.24	p=0.865	15.42±7.43	p=0.333
Iron (mg)	Below	96.0	9.75±7.98	t=-0.786	9.41±6.13	t=1.022	15.18±7.53	t=0.908
	Above	4.0	11.80±10.20	p=0.432	7.40±4.60	p=0.308	13.00±4.69	p=0.365
Zinc (mg)	Below	58.6	10.01±8.02	t=0.422	9.58±5.87	t=0.778	15.38±7.37	t=0.721
	Above	41.4	9.58±8.17	p=0.674	8.97±6.39	p=0.437	14.69±7.56	p=0.471
Manganese (mg)	Below	16.7	10.19±8.85	t=0.314	10.83±6.97	t=1.766	15.69±8.03	t=0.567
	Above	83.3	9.76±7.92	p=0.753	9.02±5.86	p=0.079	14.98±7.34	p=0.571
İodine (µg)	Below	92.8	9.82±8.14	t=-0.091	9.25±6.12	t=-0.728	14.92±7.49	t=-1.326
	Above	7.2	10.00±7.25	p=0.927	10.33±5.60	p=0.467	17.33±6.62	p=0.186
Selenium (µg)	Below	96.8	9.66±7.89	t=-1.896	9.27±6.12	t=-0.849	15.05±7.45	t=-0.542
	Above	3.2	15.13±11.73	p=0.059	11.13±4.67	p=0.397	16.50±7.56	p=0.589

[§]t: Independent Sample T-Test. *:<0.05

DISCUSSION

A total of 251 Nutrition and Dietetics students, consisting of 237 females (94.4%) and 14 males (5.6%) participated in the study. The mean age of the students was 20.63±1.51 years, and the mean BMI was 21.36±3.11 kg/m^2.

In this study, according to the DASS-42 evaluation, 'severe' and 'very severe' depression prevalence was 15.2%, anxiety prevalence was 21.6% and stress prevalence was 4.8%. Similarly, in a study conducted on 982 university students, the prevalence of 'severe' and 'very severe' depression was 27.8%, anxiety was 29.2%, and stress was 7.9%;[21] as well as, in a study on medical faculty students, it was reported as 22.2%, 22.1% and 15.5% respectively.[22] This situation can be explained by the fact that university students struggle for a variety of reasons, including academic achievement anxiety and acclimating to a new social milieu away from their families.

In this study, the depression, anxiety, and stress levels of the students, whose intakes of carbohydrates above (>140 g) and protein intakes below (W<46 g, M<56 g) the DRI recommendations, were found to be higher but these were not statistically significant. Similarly, studies in the literature indicate that reducing the intake of dietary carbohydrate and simple sugar positively affects psychological health and mood. In the study of Daneshzad et al. (2020) it was reported that the depressive symptoms were negatively associated with the highest quartile of low-carbohydrate diet (odds ratio: 0.42; 95% confidence interval: 0.17-1.01). Also, participants in the highest quartile of low-carbohydrate diet score compared with those in the lowest quartile had a 73% lower risk of anxiety.[23] Another study, conducted with 23,245 participants, confirmed an adverse effect of sugar intake from sweet food/beverage on long-term psychological health and suggested that lower intake of sugar may be associated with better psychological health.[24] Otherwise, increasing intake of dietary carbohydrates reduces depressive symptoms. It was stated that complex carbohydrates-whole grains, vegetables and

fruits boost serotonin levels which makes people calm.[11] There have also been studies that suggest no associations can be established. It was reported that low amounts of carbohydrates were not associated with increased odds of psychological disorders including depression, anxiety and psychological distress in both the Sangsefidi et al.'s (2021) study which was conducted with 7165 individuals and the Ebrahimpour-Koujan et al.'s (2019) study which was conducted with 3362 individuals.[25,26] Again, in support of this study, another study found that women who went on a 'low carbohydrate-high protein diet (30% protein, 40% carbohydrate, 30% fat)', compared to the ones on a 'high carbohydrate-low protein diet (15% protein, 55% carbohydrate, 30% fat)', experienced significant reductions in depression levels.[27] This result can be explained with the difference between digested tryptophan levels, which has an important role in the neuro-immunological signaling processes by causing an increase in the serotonin levels in the body, also with proteins having a positive effect on the mood and limited carbohydrate consumptions regulating the mood.[28] The inflammation hypothesis of depression, or broadly, common mental disorders, proposes that chronic inflammation plays an important role in the pathophysiology of these conditions. Kivimäki et al.'s (2014) findings supported the hypothesis that persistently elevated levels of IL-6 contributed to the development of common mental disorders that was explained by the increase in circulating inflammatory markers.[29] Similarly, participants who went on a 'high carbohydrate-low fat diet (46% carbohydrates, 24% protein, 30% fat)' compared to the ones that went on a 'low carbohydrate-high fat diet (4% carbohydrates, 35% protein, 61% fat) for a year, had significant reductions in depression and anxiety levels.[30] This can be explained by the fact that low fat diet contains a low risk of developing health problems such as cardiovascular diseases, especially obesity in individuals, and in this case, individuals may develop a positive mood.

In this study, students with a low percentage of energy from fat (<35%) and a low omega-3 intake (W<12 g, M<17 g) from diet according to the DRI recommendations, had higher levels of depression, anxiety, and stress but these were not statistically significant. Similarly, studies have found a negative relationship between total fat dietary and the mood.[12,31] The same, it is stated that adding food rich in omega-3 sources such as fish to the diet improves depressive, anxiety and suppression situations.[32] This can be explained by the fact that fatty acids play a role in the structure of the nervous system cells and in the synaptic transmission of neurotransmitters such as serotonin and dopamine, and depending on the type of the fatty acids, they cause an increase or decrease in the level of oxidative stress in the body.[33]

In this study, students who received fibers (W>25 g, M>38 g) above DRI recommendations with a diet were found to have lower levels of depression and anxiety but these were not statistically significant. Similarly, recent studies have shown that inadequate intake of dietary fibers is a significant risk factor for depressive symptoms.[34,35] In the literature dietary fibers are known to affect the gut microbiota composition.[36] Moreover, gut dysbiosis is observed during depression and anxiety.[37] This may be associated with dietary fiber-rich nutrition, regulating intestinal pH and permeability, maintaining beneficial bacterial balance in the gut, and altering neurotransmitter density to reduce symptoms of depression.[38] On the other hand, it can be explained by the fact that the individual suffers from indigestion because of unhealthy bowel problems, problematic defecation, and depression symptoms grow in tandem with feelings of sadness.[39]

In this study, students who received Vitamin A (W>700 µg, M>900 µg), Vitamin E (>15 mg) and Vitamin K (W>90 µg, M>120 µg) above DRI recommendations with a diet were found to have lower levels of depression, anxiety, and stress but these were not statistically significant. Similarly, recent studies have shown a negative association between vitamin A, Vitamin E and Vitamin K intake and mental disorders such as anxiety, stress, and depressive symptoms;[40-42] there are also studies showing that there is no relationship between these vitamins and moods.[43,44] This situation can be explained by the fact that the ability of Vitamin A to stimulate neurochemical systems associated with noradrenaline, serotonin and dopamine,[45] in addition to the role of Vitamin E against oxidative stress, which prevents the decrease of cognitive functions by protecting the nervous system, with ability of the cells and intracellular organelle membranes to remove free radicals with a chain-crushing antioxidant property in the lipid phase and vitamin K in blood clotting, as well as its effectiveness in the nervous system and cognitive functions, and with its ability to protect the brain against oxidative stress positive effects on moods can be explained.[46,47]

In this study, students who took Vitamin C (W>75 mg, M>90 mg) with a diet above the DRI recommendations were found to have statistically significantly lower depression, anxiety, and stress

levels. In addition, studies conducted in recent years have revealed that a lack of Vitamin C is a risk factor for depressive symptoms and anxiety levels.[48,49] This can be explained by the role of vitamin C in weakening the cortisol activity by regulating the activity of neurotransmitters serotonin, dopamine, and γ-Aminobutyric acid-GABA which act on moods by regulating serotonin levels, so they can sometimes enhance aggression and sometimes reduce the impulsivity that might lead to abnormal aggression,[50] and in the regression of mood disorders by preventing stress-related oxidative damage in the brain.[51]

In this study, dietary intake of Vitamin B-1 (W<1.1 mg, M<1.2 mg), biotin (<30 µg) and folic acid (<400 µg) below the DRI recommendations and students who took Vitamin B-5 (>5 mg) above the DRI recommendations were found to be lower depression, anxiety and stress levels but these were not statistically significant. On the other hand, students who took Vitamin B-2 (W>1.1 mg, M>1.3 mg) above the DRI recommendations were found to have statistically significantly lower depression, anxiety and stress levels. In the review made by Kennedy (2016), vitamins B-1, B-2, B-3 and B-5, which play a role in the energy production in cells, and their functions in regulating homocysteine level, and vitamins B-6, B-9, B-12 which struggle neurodegenerative disorders with their functions were reported that they are responsible for reducing depressive symptoms by lowering elevated homocysteine levels.[52] Similarly, studies conducted in recent years have shown that there is a negative relationship between insufficient levels of vitamins B-2, B-3, B-6, B-9, and B-12 and mental disorders such as anxiety, stress, and depressive symptoms.[53-55] In contrast to this study, it was discovered that people with low vitamin B-1 levels were more likely to experience depressive symptoms, and that vitamin B-1 supplementation alleviated depression and anxiety symptoms.[56] On the other hand, in the study conducted with 5,442 participants; it has been reported that folic acid, vitamin B-6 and vitamin B-12 combination supplementation did not affect depressive symptoms and did not reduce the overall risk of depression compared to the placebo group.[57] This situation can be explained by a positive effect on mood due to increase in cognitive functions, parallel to the fact that group B vitamins, which support cellular functions, act as coenzymes and cofactors in mechanisms that affect cognitive and neural functions and obtain/convert bioactive molecules with their roles in anabolic and catabolic metabolism.

In this study, depression, anxiety and stress levels of students whose dietary intake of phosphorus (<700 mg), iodine (<150 µg), selenium (<55 µg) below the DRI recommendations and who took calcium (>1000 mg), zinc (W>8 mg, M>11 mg) and manganese (W>1.8 mg, M>2.3 mg) above the DRI recommendations were found to be lower but these were not statistically significant. Similarly, studies conducted in recent years have shown that there is a negative relationship between insufficient sodium, calcium, magnesium, zinc, manganese levels and mental disorders such as anxiety, stress, and depressive symptoms.[4,5,58-60] Again, after evaluating the serum selenium levels of 3,735 participants aged 20-32 years, and doubling the serum selenium level with replacement supplementation which can increase depressive symptoms[61], showed a significant and negative relationship with the participants' depressive symptoms.[62] Again, supporting this study, in a study it was found that 4 weeks of iodine supplementation did not produce any change at the prevalence or at the level of depression.[63] In another study, no relationship could be established between iodine and anxiety.[5] In a study conducted with 14,834 adult individuals with data obtained from National Institutes of Health (NIH), an inverse relationship was found between dietary zinc, iron, copper, and selenium intake and depression under Recommended Dietary Allowance (RDA) recommendations for age and gender.[64] Unlike this study, it has been reported in the literature that limiting calcium intake may improve depressive symptoms or that there is no relationship between serum phosphorus, calcium levels and mood.[4,65-67] In a double-blind, placebo-controlled study, no association was found between 6 months of selenium supplementation and participants' well-being.[68] Again, differently, it has been reported that depressive behaviors may occur when participants' diets were high in sodium and low in potassium.[69] In a review, supplementation of selenium, zinc, and magnesium to individuals with depressive symptoms had no effect on reducing mood symptoms.[60] This situation can be explained by the fact that excessive calcium passage from bones into the blood may be a part of the mechanism that leads to mood disorders, as well as the role of zinc at high levels in the brain hippocampus in proper synaptic functioning.[4]

CONCLUSION

The moods of individuals; it causes 30-48% change in appetite, food choice, amount, and frequency of eating.[70] Depression negatively affects nutritional habits, directly or indirectly causing the development of various chronic diseases, negatively affecting the health of the productive population. As a result,

dietitians, psychologists, and psychiatrists should take a multidisciplinary approach to dealing with the problem. Furthermore, it is vital to guarantee that people have adequate and balanced diets, to implement the required policies, and to ensure that individuals have access to good meals to protect their mental health.

On the other hand, it was thought that some nutrients' dietary consumption would not be enough to help with mood disorders like depression, anxiety, and stress, and that supplementation would be required (it should be added to the daily diet as a supplement). Individuals should be educated about macro and micronutrients, as well as their impacts, which may have an impact on their mental health because of their diet. In addition, reference values for nutrients that should be consumed daily can be developed for mood disorders, which are one of the most pressing issues of our time and are becoming more prevalent in society.

Limitations of the Study

The study's limitations are the usage of vitamin/mineral supplements is not questioned, blood vitamin/mineral levels are not tested, and the majority of the Department of Nutrition and Dietetics students are female. The impacts on mood processes cannot be clearly described when antagonist factors or absorption issues produce a decrease in absorption since it is impossible to measure how much of the dietary nutrients are digested by the body according to the principle of bioavailability.

Acknowledgement

I would like to thank Mr. Abdullah Çelik, who conducted the statistical analyses of the study, and Dietitian Aslınur Okumuş, Dietitian Gizem Alışır, Dietitian Gizem Turgut, Dietitian İlayda Gürışık and Dietitian Sena Pekşen for their assistance in the data collection phase.

Conflict of interest

The author have not declared any conflicts of interest.

Funding

This work did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

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