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The relationship of diet quality and body composition with depression level in young women

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ABSTRACT. The purpose of this study was to determine how effective diet quality and body composition are in determining depression level among university-age female students. The study was designed as a cross-sectional study and conducted on 105 university female students (mean±SD, 20.3±1.9 years old). Data were collected in face-to-face interviews using questionnaire. The statistical analysis was performed with SPSS 23.0. Univariate and multiple regression analysis was performed to determine the association between participants' BDI levels and diet quality and anthropometric measurements. It was determined that 46.7% had mild and 25.7% had moderate/severe depression symptoms (mean BDI score: 13.6±7.0). Depression scores of young women were positively affected by BMI, waist circumference, waist / height ratio, fat ratio values, and negatively affected by muscle mass *(*$p< .05$*)*. The depression scores of young women were positively affected by the NAR energy and NAR carbohydrate scores *(*$p< .05$*)*. The iron, calcium and omega 3 NAR scores of young women affected the depression score significantly and negatively *(*$p< .05$*)*. This study showed that diet quality was effective in keeping the body composition within the desired values, preventing depression and so enhancing the quality of life. Improving the diet quality is important for promoting the health status and life quality.

Keywords: diet; quality; health; body composition; depression.

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Introduction

Depression is a public health problem responsible for many diseases worldwide and adversely affects the quality of life. According to World Health Organization (WHO), depression has ranked first in terms of global disease burden in 2020 (World Health Organization [WHO], 2020). As in other countries of the world, the prevalence of mental illnesses is increasing in Turkey. According to Turkstat Health Survey, the frequency of depression in Turkey was 2.8%, but this rate increased to 7.2% in 2016 (Turkish Statistical Institute, 2012; Turkey, 2018). It is stated that the onset of depression has shifted to earlier ages, and young people between the ages of 20-30 are at serious risk (Oleszko, Szczepanska, Janion, & Josko-Ochojska, 2019). Moreover, it is reported that the risk of depression is higher in young women and female gender is a risk factor for the development of depression. According to the preventive public health approach, it is essential to determine the risk factors in advance to prevent mental problems. Since the causes of depression are complex, it is very important to define modifiable risk factors and to understand the processes they operate (Jaworska, Morawska, Morga, & Szczepańska-Gieracha, 2014; Jurkiewicz & Kołpa, 2015). The dietary intake has been associated with mental health and poor diet quality and obesity have been found to be risk factor for mental disorders including depression in studies (Sánchez-Villegas et al., 2009; Nanri et al., 2010; Jacka, Mykletun, Berk, Bjelland, &Tell, 2011; Kivimäki et al., 2011). Improving diet during this period is important in reducing the lifetime risk of depression (Francis et al., 2019). Therefore the purpose of this study, was to determine how effective diet quality and body composition are in determining depression level among young women.

Material and methods

The study was conducted on 105 university female students aged between 20-29 (mean±SD, 20.3±1.9 years old). It was carried out in Ankara-Turkey, from September 2019 to January 2020. The study was approved by

the the Ethics Advisory Committee of the XXX University, Faculty of Health Sciences (19/540). Informed consent was obtained from the participants and each participant filled in the questionnaires in accordance with the declaration of Helsinki (World Medical Association).

The questionnaire included the socio-demographic features of the participants, some anthropometric measurements [body weight(kg), height (cm), body fat ratio, muscle mass and waist circumference(cm)], three-day food consumption records with a 24-hour recall method and Beck Depression scale. Data were collected in face-to-face interviews.

Anthropometric measurements

All measurements were taken by trained dieteticians in accordance with general practices. The body weight (kg), height (cm) and waist circumference(cm) measurements of the participants were collected. The body weight was measured to the nearest 0.01 kg using a digital weighing scale (SC-105 Model Electronic Scale from Bari-Med), without shoes and wearing light clothes. Height was measured to the nearest 0.1 cm using a flor-standing stadiometer (S-100 height from Ayrton) while the subjects were in upright position, with their heads held in Frankfurt horizontal plane. Waist circumference(WC) was measured at the mid-point, above the iliac crest and below the lowest rib margin at minimum respiration, using a flexible tape. Body mass index(BMI) was calculated and then, BMI was classified according to WHO (2019). Waist–height ratio was also calculated (Ashwell & Hsieh, 2005).

Dietary assessment

In order to evaluate the food consumption of participants, three-day food consumption records, two days on weekdays and one day on weekends, were collected with a 24-hour dietary recall (24HR) method. Energy and nutrient intake was calculated using the Nutrition Information System (Beslenme Bilgi Sistemi [Bebıs], 2004). Dietary Reference Intake (DRI) values by gender and age were used to evaluate energy and nutrient intakes (Institute of Medicine [IOM], 2005). In the evaluation of dietary quality Nutrition Adequacy Ratio (NAR) and Mean Adequacy Ratio (MAR) scores calculated (Kant, 1996).

Nutrition adequacy ratio (NAR)

NAR scores were calculated by comparing individual daily consumption of nutrients with reference values categorized by age and gender (12). In this study, NAR scores were calculated as a percentage for a total of seventeen nutrients, including energy, carbohydrate (CHO), protein, mono (MUFA) and polyunsaturated fatty acids (PUFA), omega 3, dietary fiber, vitamin C, riboflavin, thiamine, niacin and folic acid, calcium, phosphorus, iron, zinc, magnesium. Mean adequacy ratio (MAR)score was obtained as a percentage by averaging NAR scores calculated for seventeen nutrients (Kant, 1996).

Beck depression scale (BDI)

In the study, the depression level of the participants was evaluated with the Beck Depression Inventory (BDI) developed to measure the symptoms and the severity of depression, (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The Turkish validity and reliability study of the scale (Cronbach alpha: 0.80) was conducted (Hisli, 1988).

Depressive symptom levels of the participants based on BDI scores were determined as in Table 1.

Table 1. Depressive symptom levels of young women based on BDI scores.

Depressive symptom levels	n (%)
No Symptom/Minimal	29 (27.6)
Mild	49 (46.7)
Moderate / Severe	27 (25.7)
Total	105 (100.0)
BDI score mean±SD/Median [IQR]	13.6±7.0/12.0 [8.0]

Statistical analysis

All statistical analyses were performed with SPSS 23.0. The Kolmogorov-Smirnov test was used to determine the normality distribution of the data. Continuous variables were expressed as mean±standard deviation and median (interquartile range-IQR), and tested by one way anova test for parametric data, and by Mann Whitney

U and Kruskall Wallis tests for nonparametric data. Categorical variables were described as numbers and percentages. Univariate and multiple regression analysis was performed to determine the association between participants' BDI scores and NAR, MAR scores and anthropometric measurements. In all statistical tests, the range of reliability was accepted as 95.0% and evaluated at significance level of p< .05.

Results

The average BDI score of young women was 13.6±7.0. 46.7% of them had mild and 25.7% had moderate/severe depression symptoms. 64.8% consumed three main meals and 35.3% consumed two main meals a day. 69.5% of the women reported that they consumed more carbohydrate-rich foods and 30.5% consumed more high-fatty foods during stressful periods. BDI scores of those who consumed three main meals a day was significantly lower (U: 853.500, p: 0.007).

BDI score (BDI-score:14.0[8.0]) of women who prefered to consume foods high in carbohydrate during stressful periods was higher than those who prefered fatty foods (U: 857,500, p: 0.030).

BMI, fat ratio, waist circumference and waist/height ratio values of women with moderate/severe depressive symptoms were significantly higher and muscle mass was lower than those without depressive symptoms *(*p< .05, Table 2).

Table 2. Comparison of depressive symptom levels and anthropometric measurements of young women.

Anthropometric measurements	Depressive symptom levels			X^2	p
	No Symptom/Minimal	Mild	Moderate/Severe		
BMI (kg m^{-2})	21.0 [4.0]	20.0 [4.5]	23.0 [6.2]	13.642	.001*
Body fat rate (%)	24.0±[10.0]	22.0±[12.0]	30.0±[11.0]	10.016	.007*
Muscle mass (kg)	44.0 [5.0]	39.0 [3.5]	41.0 [5.0]	7.539	.023*
Waist circumference (cm)	77.0 [9.5]	78.0 [6.0]	83.0 [21.0]	7.704	.021*
Waist-height ratio	0.47 [0.06]	0.47 [0.05]	0.50 [0.1]	.7.577	.023*

Data presented as median [IQR] and Kruskal Wallis test was used. *p< .05.

Young women had low NAR scores from dietary fiber, thiamine, folic acid, iron, calcium, magnesium and PUFA in all three groups (Table 3). As the percentage of energy coming from carbohydrates increased, the level of depressive symptoms also increased (p< .05). Those with moderate/severe depressive symptoms had higher NAR energy (p< .05) and carbohydrate (p<.05) scores than other groups. However, their vitamin C (p< .05), iron (p<.05), zinc (p<.05), calcium (p< .05), phosphorus (p> .05), magnesium (p> .05) and PUFA (p> .05) scores were lower.

According to depressive symptom levels of women, MAR scores differed significantly. MAR score was higher in women without depressive symptoms (p< .05, Table 3).

Table 3. Comparison of depressive symptom levels and diet quality of young women.

	Depressive symptom levels			F/X^2	p
	No Symptom/Minimal	Mild	Moderate/ Severe		
NAR Enery (%)†	82.7±11.4	86.4±11.4	90.3±9.1	3.395	.037*
NAR Carybonhydrate (%)†	111.4±16.4	120.5±17.3	130.9±16.5	9.336	.000*
NAR Protein (%)	146.8 [30.9]	138.4 [30.0]	135.4 [30.6]	2.225	.329
MUFA (%)	105.6±25.6	103.7±23.0	107.7±23.1	0.254	.776
PUFA (%)	79.2 [44.4]	76.6 [43.0]	69.1 [44.2]	2.618	.270
Omega 3 (%)	190.9 [90.9]	100.0[63.6]	100.0 [45.5]	25.865	.000*
NAR Dietary fiber (%)†	65.2±13.3	59.1±15.3	63.4±12.5	1.908	.154
NAR vitamin C (%)	112.2 [83.7]	111.2 [88.9]	102.5 [88.7]	0.229	.892
NAR Thiamine (%)	54.5 [16.8]	60.0 [15.4]	63.6 [18]	0.913	.634
NAR Riboflavin (%)	130.0 [30]	122.2 [24.4]	130.0 [30]	1.781	.410
NAR Niacin (%)	78.5 [23.8]	79.8 [27.9]	83.3 [21.4]	1.195	.550
NAR Folate (%)	62.2 [33.6]	58.2 [23.0]	58.3 [22.6]	0.682	.711
NAR Iron (%)†	59.8±9.7	52.8±10.6	49.4±9.3	7.935	.001*
NAR Zinc (%)†	128.8±29.0	115.3±23.7	108.7±19.1	5.130	.008*
NAR Calcium (%)†	80.1±13.3	69.4±18.3	63.2±17.3	7.306	.001*
NAR Phosphorus (%)†	146.2±18.2	146.0±22.9	142.6±26.5	0.230	.795
NAR Magnesium (%)†	66.4±8.1	67.3±12.2	62.1±10.2	2.196	.117
MAR†	104.8 [16.3]	98.9 [12.0]	99.1 [17.2]	6.276	.043

†Data presented as mean and standard deviation, and One Way Anova test was used. Other data presented as median [IQR] and Kruskal Wallis test was used. *p< .05.

According to the results of the regression analysis, the BDI scores of the women were positively affected by BMI, waist circumference, waist/height ratio, fat ratio values, and negatively affected by muscle mass ($p< .05$). One-unit change in BMI, fat ratio, muscle mass, waist circumference, and waist/height ratio of women led to a change of 0.277, 0.269, -0.208, 0.269 and 0.226 units in the BDI score, respectively ($p< .05$). According to the results of the multiple regression analysis performed by including the BMI, waist circumference, waist/height ratio, fat ratio and muscle mass values of the students into the model, it was determined that the effect of BMI alone on the depression score was statistically significant ($p< .05$). Each unit increase in BMI enhanced the depression score by 27.7%. The BMI's rate of explaining the depression score was 7.7% (Table 4).

Table 4. Regression analysis of BDI scores and anthropometric measurements of young. women.

Variables	Univariate				Multiple			
	β	t	p	R^2	β	t	p	R^2
BMI (kg m^{-2})	0.277	2.922	.004	0.077	0.277	2.922	0.004	0.077
Body fat rate (%)	0.269	2.829	.006	0.072	-			-
Muscle mass (kg)	-0.208	-2.160	.033	0.043	-			-
Waist circumference (cm)	0.269	2.832	.006	0.072	-			-

β: Standardized regression coefficient, R^2: Explanatory coefficient.

According to the results of the regression analysis, the BDI scores of participants were positively affected by NAR energy, carbohydrate scores, and negatively affected by NAR iron, calcium and omega-3 scores ($p< .05$). One-unit change of NAR energy, carbohydrate, iron, calcium and omega-3 scores of participants led to a change of 0.265, 0.382, -0.355, -0.268 and -0.352 units in the BDI score, respectively ($p< .05$, Table 5).

According to the results of the multiple regression analysis performed by including the NAR carbohydrate, iron, calcium and omega-3 scores together into the model, the effect of carbonhydrate score on the depression score was statistically significant and positive ($p< .05$), while the effect of iron ($p< .05$) and omega-3 ($p< .05$) scores on depression score was statistically significant and negative (Table 5).

Each unit increase in carbonhydrate enhanced the depression score by 29.6%, each unit increase in iron decreased the depression score by 29.4%, and each unit increase in omega-3 decreased the depression score by 27.3%. The model's rate of explaining the depression score was 31.4% (Table 5).

Table 5. Regression analysis of BDI scores, NAR and MAR scores of young women.

Variables	Univariate				Multiple			
	β	t	p	R^2	β	t	p	R^2
NAR Energy (%)	0.265	2.792	.006	0.070	-			-
NAR Carbonhydrate (%)	0.382	4.196	.000	0.146	0.296	3.517	.001	
NAR Iron (%)	-0.355	-3.857	.000	0.126	-0.294	-3.537	.001	0.314
NAR Omega-3 (%)	-0.352	-3.813	.000	0.124	-0.273	-3.252	.002	
NAR Zinc (%)	-0.187	-1.931	.056	0.035	-			-
NAR Calcium (%)	-0.268	-2.819	.006	0.072	-			

β: Standardized regression coefficient, R^2: Explanatory coefficient.

Discussion

In some studies conducted during the last 10 years on young people in Turkey, the proportion of young people showing depressive symptoms at various levels ranges from 18.3 to 38.3% (Deveci, Ulutaşdemir, Yasemin, 2013; Ulas, Tatlibadem, Nazik, Sonmez, & Uncu, 2015). In this study it was revealed that 46.7% of young women had mild depression, and 25.7% had moderate/severe depressive symptoms.

There is not much knowledge and findings about the relationship between depression and body composition (Speed, Jefsen, Børglum, Speed, & Østergaard, 2019); generally, the relationship between BMI and depression has been emphasized in existing studies (Pahalı, Omay, Bulut, & Sayar, 2018). However, in their study Speed et al. (2019), reported that although BMI was a risk factor for depression, it did not differentiate between fat mass and lean body mass and the BMI-depression causation was driven by fat. Also, studies examining the relationship between BMI and depression are inconsistent. While there is no relationship between BMI and depression in some studies (Rivenes, Harvey, & Mykletun, 2009), there is a significant correlation in others (Simon et al., 2006). Therefore, it is important to evaluate BMI and other anthropometric parameters together. As to this study, it was found that as the BMI, fat ratio, waist circumference and waist/height ratio of young women increased, their depression level increased, and that

values of young women with moderate/severe depressive symptoms were significantly high, while muscle mass was low ($p < .05$). One unit change in BMI, fat ratio, muscle mass, waist circumference and waist/height ratio of young women resulted in a change of 0.277, 0.269, -0.208, 0.269 and 0.226 units in the BDI score, respectively ($p < .05$). According to the results of multiple regression analysis, it was determined that the effect of BMI alone on the depression score was statistically positive and significant ($p < .05$). Each unit increase in BMI enhanced the depression score by 27.7%. The BMI's rate of explaining the depression score was 7.7%. In other studies, similarly, there was a relationship between waist circumference and depression (Zhao et al., 2011). In another study conducted on young women in similar age range with our study, it was found that depression scores were positively correlated with BMI and fat ratio, but negatively correlated with muscle mass and bone mass (Zhu et al., 2017). The relationship between these parameters evaluating body composition with increasing depression level can be explained by the fact that individuals with depression consume more carbohydrates and fats. Indeed, the situation that will support this assumption is also supported by the result in this study that participants with higher depression level consumed more carbohydrate and fat.

Nutrition can play a key role in the onset, severity, and duration of depression. Behaviors such as loss of appetite, skipping meals and increased cravings for sweet foods are associated with depression (Rao, Asha, Ramesh, & Rao, 2008). Supportingly, in this study, the BDI score of young women who consumed three main meals a day was found to be significantly lower than those who consumed two main meals a day ($p < .05$).This shows that regular consumption of three main meals contrubutes positively to the prevention of depression.

The role of diet in the development of depressive disorders and symptoms has become the focus of recent studies. Poor diet quality has been reported as an important risk factor for depression. There are studies reporting that individuals with depression had low diet quality and that their diet content were poor in terms of protein, vitamins and minerals; rich in saturated fat and simple carbohydrates (Camilleri et al., 2014; Lai et al., 2014). When the diet quality was examined according to depressive symptom levels, MAR scores were found to differ significantly and were higher in those without depressive symptoms ($p < .05$). This result shows that as the diet quality of the participants increase, their depressive symptom levels decreases and that means more unhealthy foods were in their diet (Rao et al., 2008).

The quality of the diet indicates how well individuals comply with the recommended dietary pattern and the diversity in their diet (Charney & Steiber, 2017). It was reported that the desire to eat sweet and carbohydrate increased in depressive states due to the positive relationship between dietary carbohydrate intake and depression (Brinkworth, Buckley, Noakes, Clifton, & Wilson, 2009). In this study, the level of depression increased as carbohydrate scores increased ($p < .05$). When nutrition adequacy ratios were analyzed according to depression levels, those with moderate/severe depressive symptoms had higher carbohydrate scores than other group ($p < .05$) and each unit increase in NAR carbohydrate score enhanced the depression score by 29.6%.

Another finding of this study was that 69.5% of young women consumed more carbohydrate-rich foods and 30.5% consumed more high-fat foods. Also, the BDI score of those who preferred to consume carbohydrate-rich foods during their stressful periods was found to be higher ($p < .05$). These results support each other. Consuming more food than normal and choosing foods that are high in simple carbohydrates, easy to prepare and sweet during stressful times are common behaviors to cope with stress (Flaskerud, 2015). However, excessive consumption of these foods cause an increased risk of depression (Sánchez-Villegas et al., 2012). Paans et al. (2019) found that depression leads to higher intake of sweets and snacks/fast food, and so decreased in dietary quality. This is explained as a vicious circle. Foods with simple carbohydrates can cause fluctuations and collapses in blood sugar accompanied by a fluctuation in adrenaline or epinephrine and worsen the body's response to stress (Flaskerud, 2015). Young women should be informed about the healthy food choices, their relation with nutrients, and should be directed to apply ideal diet models such as Mediterranean type which is accepted to be healthier.

Some studies on proteins, have shown that high protein intake is associated with reduced incidence of depression (Nanri et al., 2014; Pooyan et al., 2018). Similarly, in this study, it was observed that as the protein intake of young women decreased, their depression levels increased ($p > .05$). On the other hand, Wolfe et al. (2011) found that diet with high protein has a protective effect against depression in men, but not in women. Inconsistent results in the studies may be related to the age of the participants.

Increasing evidence in recent years has shown that omega-3 polyunsaturated fatty acids are effective in healing depression (Guu et al., 2019; Liao et al., 2019). In the study, it was determined that as the omega-3

(p< .05) adequacy scores of women decreased, their depression levels increased. According to the results of the regression analysis, a change in the NAR omega-3 ratio caused a 0.352 unit change in the BDI score (p< .05),andeach unit increase in NAR omega-3 reduces the depression score by 27.3%. In this context, awareness should be raised on including dietary omega-3 sources in diets. This will be the right approach due to its positive contributions to health.

Some vitamins and minerals are reported to improve symptoms of depression. The relationship between depression and dietary composition/quality is particularly associated with B group vitamins such as folate, B6, B12 and minerals such as zinc, iron and magnesium (Murakami et al., 2008; Sánchez-Villegas et al., 2009). In a study it was revealed that vitamin B1, B2 and B6 supplements improved mood in both genders (Benton, Haller, & Fordy, 1995). In a meta-analysis study, an inverse relationship was found between dietary zinc, iron intake and the risk of depression, and it was revealed that the risk of depression was higher in the group with the lowest dietary intake of iron and zinc compared to the groups with normal and higher dietary intake (Li, Li, Song, & Zhang, 2017). In this study, it was found that as the dietary iron and zinc intakes of young women decreased, their depression levels increased (p< .05). According to the results of regression analysis, one unit change of NAR iron ratio led to a change of -0.355 units in the BDI score (p< .05), and each unit increase in NAR iron reduces the depression score by 29.4%. Vitamin C is effective in stress-induced psychological diseases and depression due to their role in oxidative processes (Moritz, Schmitz, Rodrigues, Dafre, & Cunha, 2020). Indeed, in this study, as the intake of vitamin C of young women decreased, their depression levelsincreased (p> .05).

There are studies in the literature revealing the negative relationship of low calcium and magnesium levels with depression (Jung, Ock, Chung, & Song, 2010). In this study, it was determined that as the calcium *(*p< .05), phosphorus (p> .05), magnesium (p> .05) scores of young women decreased, depression levels increased. The NAR calcium score of young women in the study affected the depression score significantly and negatively (p< .05). It is thought that consuming less foods containing these nutrients can lead to these results in participants who are more likely to eat an unhealthy diet.

There were some limitations in this study. Firstly, the study is conducted on a small sample due to the voluntary principle. In future studies, there is a need for large sample. Secondly, the participants may give insufficient information as a result of the possibility of forgetting about their dietary intake. However, it is thought that the study will contribute to the literature since it was conducted on young women considered as one of the risky groups in terms of public health and nutrition, and the results reflect the relationship between depression status, body composition and diet.

Conclusıon

Consequently, this study showed that as the dietary quality decreased, the level of depression increased.The diet quality, depression, and body composition affect each other. Diet quality, was effective in keeping the body composition within the desired values, preventing depression and so enhancing the quality of life. The fact that depression makes changes in all aspects of human life requires a more accurate approach to be evaluated. Depression is one of the important health problems threatening young people. In this age group, especially in young women among whom the depression is more common, it is important to conduct studies that will determine the presence and the level of depression in order to take precautions before it is too late for possible adverse conditions. In addition, improving the diet quality is important for promoting the health status and life quality of the young.

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