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ORIGINAL PAPER

The Relationship Between Nutritional Status and Diet Quality, and Depression, Anxiety and Stress Levels in Obese Adults

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ABSTRACT:

PURPOSE: This study aims to investigate the effect of nutritional status and dietary quality on depression, anxiety and stress in adult obese patients.

DESIGN: The study was conducted with 103 adult obese individuals. A questionnaire, including descriptive characteristics, physical activity, nutritional habits, anthropometric and some biochemical measurements, Mediterranean diet score (Med score) and Depression-Anxiety-Stress Scale (DASS), was applied to the individuals.

FINDINGS: Body mass index (BMI) value was found to be significantly higher in those with poor compliance with the Mediterranean diet (p=0.012). As the anxiety scale score increases, BMI, stress and depression increase and Med score decreases. While depression, anxiety and stress scores increase, BMI value increases; compliance with the Mediterranean diet decreases.

VALUE: Our results show that mood and BMI influence Mediterranean diet quality. It has proven that it is necessary to look at mood and obesity levels when assessing an individual's nutritional status.

KEYWORDS: *Mediterranean Diet; Nutrition; Diet quality; Mood; Obesity*

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INTRODUCTION

Obesity has psychological, physiological, hormonal, metabolic, social and aesthetic effects and has become a global problem seen in 30.3% of our society; nutrition and lifestyle have been shown among the most important causes of obesity. The nutritional status of a person may change according to the presence of external factors including education level, income level, socio-cultural factors and environment (GDHR, 2014; Public Health Directorate, 2017; Şahin, 2015). In recent years, more emphasis has been placed on a person's diet than their intake of nutritions and evaluation of food consumed in examining the effects of these kinds of diet styles on health (Schröder, 2007).

A Mediterranean diet is one of the most popular dietary models today for various reasons including having a protective effective against various diseases such as cardiovascular, obesity and diabetes and for prolonging survival time (Barbaros and Kabaran, 2014; Kanauchi and Kanauchi, 2016; Sofi *et al.*, 2008; Trichopoulou *et al.*, 2003). While the Mediterranean diet increases the consumption of vegetables, fruit, legumes, oil seeds and grains, it limits the consumption of food high in sugar and saturated fat (Barbaros and Kabaran, 2014; Serra-Majem *et al*., 2004). It has been shown by some studies that a Mediterranean diet reduces the risk of developing many diseases such as oxidative stress and depression due to being a model that supports the consumption of micronutrients such as selenium, zinc, magnesium, olive oil, seafood and fish and antioxidants (Milaneschi *et al.*, 2011; Quirk *et al.*, 2013). In addition, a study conducted in Spain showed that a Mediterranean diet may increase the health related quality of life as a result of improving a person's general physical health, emotional role and health perception. It can also be effective in improving weight loss and risk factors of metabolic syndrome by improving the functions of some physical and mental areas in individuals (Landaeta-Díaz *et al.*, 2013).

The term diet quality used for evaluating a society's dietary habits is characterised by deficiency in the consumption of some food types and particular healthy food taking place in mediterranean diet model and associated with low mental and physical health (Muñoz *et al.*, 2008). Some people with depression caused by stress may choose unhealty food (Gibson, 2006; Laitinen *et al.*, 2002). It has also been stated that symptoms such as low energy and lack of interest in activities due to depression may affect diet quality; this is due to a lack of energy or motivation to prepare or enjoy meals (Gibson-Smith *et al.*, 2018). In addition, there are consistent and observational studies suggesting diet quality can be a changeable risk factor in mental disorders such as depression and anxiety; there are studies providing pre-clinic evidence that dietary interventions can be useful in diagnosed clinical cases (Marx *et al.*, 2017; Parletta *et al.*, 2019).

Social exclusion, bullying, prejudice, contempt and discrimination in various professional fields against obese individuals are common in societies. As a result, obese individuals become more vulnerable to pyschological issues due to decreased self-respect: eating can sometimes be seen as a way of coping. As a result of disorders such as depression and stress, some individuals develop obesity. It is also thought that problems and anti-psychotic medicine have an effect on overeating and weight gain (Balcıoğlu and Başer, 2008; Cooke and Wardle, 2007).

There are insufficient studies that suggest that psychological effects such as depression, anxiety or stress are associated with nutritional status and diet quality in obese individuals. This paper aims

to study obese individuals eating a Mediterranean diet and its effect on depression, anxiety and stress levels. Previous research has studied these individually, and there are few studies reflecting the effects of all terms.

METHODS

Ethical Standards Disclosure

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Ondokuz Mayıs University Clinical Research Board (Approval number: B.30.2.ODM.0.20.08/36) and Research Approval was obtained from İstanbul Public Health Directorate (Approval number: 64222187/030.03). Written informed consent was obtained from all patients.

Participants

The sample of this cross-sectional study included individuals who met the criteria and agreed to participate; consent was obtained from all individuals. Participants were between the ages of 20 and 65 and applied to the diet polyclinic of the Community Health Center in Arnavutköy, Istanbul between 10 January 2016 and 10 April 2016; 103 participants had a BMI of 30kg/m^2 and above, 73 were female (n=73) and 30 were male (n=30) obese adults. As a result of the power analysis conducted according to the number of patients admitted to the outpatient clinic between the dates of the study, the number of participants was decided. The sample calculation of the study was calculated using the G*power 3.1 program. The effect size was 0.20, alpha=0.05, the power was 83% and the sample size was 103.

Data Collection

The data about descriptive and physical activity of individuals, anthropometric measurements (height (cm), body weight (kg), waist circumference (cm), body fat percentage (%), and BMI (kg/m^2)), dietary habits and biochemical measurements (fasting blood glucose, B_{12} vitamin (pg/dl), LDL cholesterol (mg/dl), HDL cholesterol (mg/dl), total cholesterol (mg/dl), triglyceride (TG)(mg/dl)), Mediterranean Diet Score (Med Score) applied to evaluate the quality of Mediterranean Diet and DASS to determine the mood were collected face-to-face by the researcher via a questionnaire.

The height (cm) of the individuals was measured without shoes, with the shoulders leaning against the wall, feet side by side and head at Frankfort level, using a Seca 206 height measuring device (Robbins and Trowbridge, 1984). Body weight, body fat percentage and BMI measurements were made bare foot and with light clothes by using a bioelectric impedence device (Tanita BC-418). The BMI data were obtained according to body weight (kg/height m^2) formula; using the World Health Organization (WHO) as reference, individuals with 30kg/m^2 BMI and over were considered obese. According to this classification, individuals with BMI value between 30-34.99kg/m^2 were considered as 'first degree obese', those with 35-39.99kg/m^2 as 'second degree obese' and those with ≥40.00kg/m^2 as 'third degree obese' (WHO, 2004). Waist circumference was measured using a non-stretch tape that passes through the midpoint of the distance between the crystalline

and palpated lowest rib (Robbins and Trowbridge, 1984); this indicates >80cm risk for women and >88cm high risk for women in line with WHO criteria (2008); for men, a risk of >94cm and a high risk of >102cm were assessed. Biochemical parameters of individuals were analysed at Public Health Laboratory of İstanbul Public Health Directorate. Blood samples of individuals were taken after twelve-hour fasting.

The Mediterranean Diet Score

A 14-question Mediterranean Diet Score, developed by Martinez-Gonzalez *et al.* (2012) and adapted into Turkish by Gönder (2015), was used in order to measure the adaptation of individuals to a Mediterranean diet. Two questions examined diet consumption habits and twelve examined food consumption frequency. For each question either 0 or 1 was used according to the criteria described. A maximum of 14 points and a minimum of 0 points could be obtained on the scale.

The Depression Anxiety and Stress Scale (DASS)

A Likert-type scale, DASS (developed by Lovibond and Lovibond (1995) and adapted into Turkish by Akın and Çetin (2007)), was used to determine individuals' mental health. The scale has 42 questions in total, 14 questions each about depression, anxiety and stress. While scoring, the answers given by the individuals took values between 0 (never) and 3 (always), grouped according to the total score as normal, mild, moderate, advanced and very advanced (Akın and Çetin, 2007; Lovibond and Lovibond, 1995).

Statistical Analyses

SPSS 22.0 was used for statistical analysis of the study. A Shapiro-Wilk test was applied to examine normality distribution of numeric variables and a normal distribution was obtained. Parametric tests were used in the dataset. Frequency, percentage, arithmetic mean, standard deviation, minimum and maximum values were used in the analysis of descriptive statistics. As the scales are appropriate to normality distribution, an independent t-test was used to compare the average of two independent groups, and a one-way ANOVA test for independent groups more than two. Pearson correlation analysis was done to study the relationship between research variables. The results were evaluated at 95% confidence range and $p \leq 0.05$ significance level; a correlation analysis was run. Correlation analysis shows the strength of the relationship between variables. Whether the correlation coefficient is negative or positive determines the direction of the relationship; weak if this coefficient is under 0.40; normal between 0.40-0.60, and powerful between 0.60-1.0.

RESULTS

This study researched the nutritional status of obese adults and Mediterranean diet quality effect on depression, stress and anxiety levels. The average age for the women was 39.71±10.35 years, and 40.03±10.29 years for the men. Individuals' anthropometric measurements and general characteristics are shown in Tables 1 and 2.

Table 1: Weighted Mean and Standard Deviation of Anthropometric Measurements of Individuals (N=103)

Anthropometric Measurements	Mean	SD	Lower-Upper
Height (m)	1.6	0.09	1.46-1.90
Weight (kg)	94.2	15.29	69.1-148.1
BMI (kg/m^2)	35.9	5.45	30.0-59.3
Waist circumference (cm)	102.7	11.42	80.0-144
Body Fat (%)	37.9	7.35	21.4-53.2

Note: BMI: Body mass index
Source: Constructed by authors

Table 2: General Characteristics of Individuals

	Number (n)	%
Gender		
Men	30	29.0
Women	73	71.0
Health Issue		
Yes	48	47.0
No	55	53.0
Diet Status		
Yes	40	39.0
No	63	61.0
TV Watching Duration/Day		
1-2 hours	26	25.0
3-4 hours	45	44.0
More than 4 hours	13	13.0
Do not watch TV	19	18.0
Prevelances of Depression, Anxiety and Stress		
Depression		61.0
Anxiety		76.8
Stress		66.0
Classification of Mediterranean Diet Score*		
≤5	61	59.0
Between 6-9	36	35.0
≥10	6	6.0

Notes: Prevelances of depression, stress and anxiety were measured by the DASS questionnaire
*Mediterranean diet score was measured by the Mediterranean Diet Score questionnaire
Source: Constructed by authors

The average BMI and waist circumference of the participants were 35.9±5.45kg/m^2 and 102.7±11.42cm respectively. WHO considers >80cm risk and >88cm high risk for women; >94cm and >102cm as a high risk as for men (WHO, 2008). In this study, mean waist circumference was 106.8±9.50cm in men and 101.1±11.80cm in women; both groups were considered to be high risk (Table 1).

Of the participants in the study, 41% (n=42) stated that they exercised regularly. Of these, 58% (n=25) stated that they walked, 20% (n=7) pilates/aerobic, 7% (n=3) jogging, 15% (n=7) other exercise types. In addition, 39% (n=40) were on a diet now or previously, 40% (n=41) of their diet was recommended by a dietician; 44% (n=45) stated that they watched TV for 3-4 hours, and 18% (n=19) stated that they never watched TV. The prevalence of depression was 61% (n=63), anxiety was 76.8% (n=80), and stress was 66% (n=68). The participants' mean Mediterranean diet score was 5.1±2.47. When the Mediterranean diet scores are evaluated, 59% (n=61) of the individuals scored 5 or less, 35% (n=36) between 6-9 and 6% (n=6) 10 and above (Table 2).

When the relationship between the blood values of the individuals and their diet quality was examined, the average LDL value of individuals with a Mediterranean diet score of 5 and below is higher than the average value of individuals with a score of 10 and above ($p \leq 0.05$). When the situation was evaluated in terms of HDL and cholesterol, although there were positive changes, no statistical difference was found ($p > 0.05$). Although it was not statistically significant, a decrease in vitamin B_{12} level was also observed (Table 3).

Table 3: Anthropometric and Some Blood Parameters Distribution According to Mediterranean Diet Scores

	Mediterranean Diet Scores[1]						
	≤5		Between 6-9		≥10		
	Mean	SD	Mean	SD	Mean	SD	*p*
Blood Value							
FBG (mg/dL)	101.47	32.8	100.51	26.62	102.00	21.37	0.986
Vit B_{12} (pg/mL)	194.60	98.6	197.90	75.10	156.00	25.09	0.558
LDL (mg/dL)	125.26	32.21	114.06	26.97	95.05	32.15	**0.031***
HDL (mg/dL)	45.83	8.78	48.72	24.28	49.20	5.10	0.652
Total Cholestrol (mg/dL)	201.30	41.40	189.90	44.70	173.20	25.70	0.179
Triglyceride (mg/dL)	162.50	126.00	174.10	198.10	178.70	72.70	0.921
Anthropometric Measurements							
Weight (kg)	94.8	17.2	92.7	12.6	97.0	9.0	0.723
Height (cm)	159.9	7.0	164.0	10.0	176.0	8.0	**0.000***
BMI (kg/m^2)	37.1	6.2	34.7	3.7	31.4	1.1	**0.012***
Waist circumference (cm)	103.7	13.1	101.1	8.4	102.8	9.0	0.563

Notes: FBG: fasting blood glucose, LDL: low density lipoprotein, HDL: high density lipoprotein, *=p<0.05;
[1]One-Way ANOVA. All significant adjusted p values are shown in bold
Source: Constructed by authors

While diet quality did not make a significant difference in weight and waist circumference, it did create a statistically significant difference in terms of height and BMI. Those with the highest Mediterranean diet quality were found to have the highest height and the lowest BMI. The highest average BMI was calculated for those with Mediterranean diet score of 5 and below; that is, a significant difference was found between the height BMI values from the anthropometric measurements of the study participants and the Mediterranean diet groups (p=0.000; p=0.012). While the average weight of those with the highest diet quality was 97.0±9.0kg and the average waist circumference was 102.8±9.0cm, the average weight of those with a Mediterranean diet score of 5 and below was 94.8±17.2kg, their average height was 159.9±7.0cm, and their average waist circumference was 103.7±13.1cm (Table 3).

The anxiety scores of those with a BMI value between 30.0-34.9kg/m^2 differ according to the Mediterranean diet scores (p<0.05). It was observed that individuals with the lowest Mediterranean diet score had a higher average anxiety score than those with the highest diet score (Table 4).

Table 4: Comparison of Individuals' BMI Values According to Mediterranean Diet Scores in Terms of DASS Scores

	Mediterranean Diet Scores[1,†]									
	≤5			Between 6-9			≥10			
	Mean	SD	Lower-Upper	Mean	SD	Lower-Upper	Mean	SD	Lower-Upper	*p*
BMI (kg/m²) 30,0-34,9										
Depression	10.7	11.3	0-37	11.3	5.9	3-23	3.5	2.8	1-7	0.170
Anxiety	17.4	11.0	0-30	18.5	7.3	0-24	4.0	3.7	0-11	**0.031***
Stress	13.3	8.2	1-38	12.6	7.7	6-29	11.7	4.0	6-17	0.287
BMI (kg/m²) 35,0-39,9										
Depression	18.3	7.6	4-32	10.1	8.3	0-30	-	-	-	**0.010***
Anxiety	21.3	8.1	11-36	12.7	6.8	4-24	-	-	-	0.078
Stress	26.3	13.0	1-42	18.2	10.2	4-33	-	-	-	**0.005***
BMI (kg/m²) ≥40										
Depression	18.6	9.5	2-40	14.7	15.6	0-31	-	-	-	0.554
Anxiety	17.9	8.3	6-32	13.7	3.5	10-17	-	-	-	0.396
Stress	23.8	9.2	11-38	18.7	11.0	8-30	-	-	-	0.400

Notes: *=p<0.05; [1]One-way ANOVA test. All significant adjusted p values are shown in bold. BMI: Body mass index. [†]Mediterranean diet score was measured by the Mediterranean Diet Score questionnaire
Source: Constructed by authors

Among individuals with a BMI between 35.0-39.9kg/m^2, the average depression and stress score of those with a Mediterranean diet score of 5 and below is higher than the average depression and stress score of those with a diet score between 6-9 (p<0.05); however, their anxiety scores

showed no significant difference. Depression, anxiety and stress scores of individuals with BMI of 40kg/m^2 and above did not differ according to Mediterranean diet scores (p>0.05) (Table 4).

There was nobody with a BMI value of 35.0kg/m^2 and above among the individuals with the highest compliance with the Mediterranean diet 10 in the study (Table 4).

The relationship between the scales was shown by correlation analysis and the correlation coefficient was shown as the Pearson correlation coefficient. Here, a negative linear and significant relationship between Mediterranean diet score and BMI (r: -.351; p: 0.000≤0.01), there is a positive linear and significant relationship between depression (r: 0.278; p: 0.004≤0.01), stress (r: 0.225; p: 0.022≤0.05) the anxiety scale (r: 0.297; p: 0.002≤0.01), and the BMI value. That is, as the depression, stress and anxiety scale scores increase, the BMI value increases and the Mediterranean diet score decreases (Table 5).

Table 5: Correlation Analysis of BMI, Mediterranean Diet Score (Med Score) and DASS

		BMI	Mediterranean Diet Score	Depression	Stress
Mediterranean Diet Score	r	**-0.351**			
	p	**0.000****			
	n	103			
Depression	r	**0.278**	**-0.399****		
	p	**0.004****	**0.000***		
	n	100	100		
Stress	r	**0.225**	-0.173	**0.593**	
	p	**0/022***	0.081	**0.000****	
	n	100	100	100	
Anxiety	r	**0.297**	**-0.388**	**0.717**	**0.610**
	p	**0.002****	**0.000***	**0.000****	**0.000****
	n	100	100	100	100

Notes: **=p<0.01; *=p<0.05; Pearson correlation test. All significant adjusted p values are shown in bold
BMI: Body mass index
Source: Constructed by authors

DISCUSSION

In this study, the mean age of women was 39.71±10.35 and the mean age of men was 40.03±10.29 years. The mean height and BMI of the individuals were 1.6±0.09m, 35.9 5.45kg/m^2, respectively, and the mean body fat percentage (%) was calculated as 37.9±7.35%. The mean waist circumference was 106.8±9.50cm in men and 101.1±11.80cm in women; according to WHO criteria, both groups were considered at high-risk.

In a study conducted in Brazil with obese adults between the ages of 20 and 60, the mean age and height were 44.51 years and 1.6m for women (n=37, 75%), and 43 years and 1.75m in

males (n=12, 25%) (Carvalho-Ferreira *et al.*, 2012). Park *et al.* (2017) examined the effect of a Mediterranean diet on insulin resistance and inflammation; they gave the average BMI and body fat percentage as 25.8±0.1kg/m^2 and 29.0±0.3 %, respectively. The criteria for Park *et al*.'s participants included factors such as individuals with low and normal BMIs. South Korea's quite low obesity rate when compared to Turkey's and the majority of participants in our study being obese women can be considered as the reason for the differences between Park *et al*.'s results and ours.

In a study examining cardiometabolic benefits and effects of a Mediterranean diet on body composition in obese patients with metabolic syndrome, the average of weight and BMI of the participants were found as 101.5±18.6kg and 38.6±6.9kg/m^2, respectively. In the same study, the average waist circumference was 99.3±19.4cm in women and 104.5±17.3cm in men; according to WHO criteria, both men and women were considered at high risk, similar to our study (Di Daniele *et al.*, 2013). Similar to the literature, the results obtained were higher in men; it was thought that the differences may be due to sex hormones that make a difference between genders. In addition, the reason for the high waist circumference measurements in women can be shown to be that the women in the sample were 40 years old and obese.

It was determined that approximately half this study group had a concomitant health problem. Approximately one third of participants used medication, only two fifths were on a diet, and only one third received these dietary recommendations from a specialist (dietician). In Karaduman's (2015) study on popular diets, it was shown that although the sources where diet is learned differ according to gender, it was stated that resources such as television/magazines/newspapers were used more than dieticians in both genders. Today, it can be evaluated that the concepts of weight loss, nutrition and diet that media mention mostly are more accesible on TV. It is also seen that people tend to believe and accept those on TV as specialists.

The low energy expenditure of people in sitting or lying positions constitutes the sedentary behaviour pattern (Harvey *et al.*, 2013). Sedentary behaviour, low physical activity levels, and unhealthy diet patterns are important risk factors for many major chronic diseases, including obesity (Jezewska-Zychowicz *et al.*, 2018). Previous studies have shown an association between TV viewing time and obesity, cardio-vascular risk factors, metabolic syndrome, and type 2 diabetes (Dunstan *et al.*, 2005; Fung *et al.*, 2000). It has also been associated with extra calorie intake during TV viewing (Bowman, 2006; Scully *et al.*, 2009; Van den Bulck and Van Mierlo, 2004). Approximately one out of four participating in this study stated that they watch TV for 1-2 hours a day, one out of every five 3-4 hours a day, and one to two out of ten people more than 4 hours a day. In the study, in which Andrade-Lima *et al.* (2020) examined the effect of physical activity on depression, 51% stated that they watched TV for 2 hours or less, while 13% watched TV for 4 hours or more. Of the participants, 44% had at least one chronic disease and obesity was one of the most observed chronic diseases. Another result of the study was that those with inactive and chronic diseases also observed more depression symptoms than active individuals without a chronic condition (Andrade-Lima *et al.*, 2020). In this study, although the rate of those who watched TV for more than 4 hours was low, the prevalence of depression was calculated as 61%; 47% of the

participants had at least one health problem. In addition, TV watching time of obese participants and the low diet quality of 59% of them may be related to the sedentary behaviour patterns that cause them to prefer easy snacks based on fat and carbohydrates instead of eating foods that are difficult to prepare, such as vegetables and fruit.

Gönder's (2015) study states that the rate of those who stated that they did physical activity was 30.2%. In the same study, walking was the most preferred exercise with 89.5%, while 4.6% of the participants prefer aerobic and Pilates. The rate of those who stated that they exercise regularly was found to be 40.7%. When evaluated according to the exercises performed, walking with 58% and Pilates/aerobic with 20% were preferred. The fact that the region where the individuals live does not have suitable conditions for other exercises, such as running and football, and that the majority of participants were women may have affected the preferences.

It is known that with the effect of dietary fibre and many phytochemicals taken in the Mediterranean diet provides a variety of food in nutrition. It increases antioxidant activity, balances blood glucose levels, lowers LDL cholesterol levels, and helps protect heart and general health by increasing HDL cholesterol levels. In addition, phytosterols, whose intake increases with the consumption of whole-grain foods and oilseeds, that have an important place in the Mediterranean-style diet model, lower blood cholesterol levels (Barbaros and Kabaran, 2014).

It has been hypothesised that the effect of the Mediterranean diet on cardiovascular health is due to blood lipids. It is stated that with an increase in the Med score, there is an increase in HDL cholesterol level, and a decrease in the ratio of total cholesterol/HDL cholesterol (Mertens *et al.*, 2014). Several studies have shown an inverse relationship between the Mediterranean diet score and LDL cholesterol levels (Koloverou *et al.*, 2016; Mertens *et al.*, 2014; Ruiz-Cabello *et al.*, 2017; Tuttolomondo *et al.*, 2019). In a study where the cardiometabolic benefits of the Mediterranean diet were examined, the LDL cholesterol, triglyceride, total cholesterol and total cholesterol/HDL cholesterol ratios of the group with the lowest adherence according to the Mediterranean diet scores were calculated at the highest level. However, HDL cholesterol values were the highest in the same group (Tong *et al.*, 2020). In this study, as the Mediterranean diet score increases, LDL and total cholesterol levels decrease and HDL cholesterol increases. It is thought that the small sample size and the fact that it consists of more women may have affected the results.

The traditional Mediterranean diet increases the consumption of vegetables, fruit, nuts and unrefined grains. Olive oil consumption is high, but saturated fat consumption is low; it is a diet that keeps the consumption of poultry and red meat low while increasing fish consumption (Trichopoulou *et al.*, 2003). When looking at the vitamin B_{12} values found in animal food such as milk, cheese, eggs and red meat, the lowest value in this study was calculated in participants who got 10 and above from the Mediterranean diet scale with the highest adherence to the Mediterranean diet (Table 3). However, no significant difference was observed in vitamin B_{12} values according to Mediterranean diet scores. Since there are few studies examining the relationship between vitamin B_{12} and Mediterranean diet scale groups, the results were observed in this study.

When the weighted averages of the participants' BMIs in the study were evaluated, the highest depression scores among individuals with the least adherence to the Mediterranean diet were observed in morbidly obese patients. As the Mediterranean diet scale scores increase, the severity of obesity decreases. The BMI weighted averages of those with a good diet quality, that is, Med score 10 and above, were calculated lower than those with Med score 5 and below (Table 3). It is thought that this is due to the fact that the Mediterranean diet provides a balanced diet and contains various macro-micronutrients, which are the main factors in preventing obesity. In other studies, it was stated that the group with the lowest Mediterranean diet score had higher values in terms of BMI and waist circumference compared to the group with the highest Mediterranean diet score, and was parallel to our study (Aşit, 2018; Cooke and Wardle, 2007; Park *et al.*, 2017). However, more detailed comparisons could not be made, since the number of people participating in our study was not evenly distributed among the groups according to diet quality.

The number of studies showing that the diet quality and nutritional model are related to depression, stress and anxiety are increasing. High quality diets can positively affect mood. Although the positive effects of healthy diet models on general health are known, they have no effect on cognitive function (Crichton *et al.*, 2013). There are also studies in which there is no significant relationship between unhealthy diet patterns and depression, anxiety, and stress scale scores (Nasir *et al.*, 2018). Sadeghi *et al.* (2019) found high grain intake is positively associated with depression, anxiety and psychological distress. However, they predicted a decrease in the development of depression, anxiety and stress symptoms with dietary fibre, polyunsaturated fatty acids, fruit and vegetable-rich diet patterns. Sadeghi *et al.* (2019) found that, among the two groups with high and low adherence to the Mediterranean diet, participants with the highest compliance with the Mediterranean diet had lower rates of depression, anxiety and psychological distress compared to those with low compliance. It is stated that negative emotions caused by distress can increase eating behaviour with the development of emotional eating behavior (Sevinçer and Konuk, 2013).

For example, high tendency for high-fat and sugary food when stressed can lead to a departure from the healthy Mediterranean diet and a global increase in obesity (Xenaki *et al.*, 2018). According to some studies, emotional eating behaviour was found in individuals with high BMI (Blair *et al.*, 1990). In this study, the anxiety, stress and depression scores of those with a BMI between 30.0-34.9kg/m^2 were calculated the lowest in individuals with the highest compliance with the Mediterranean diet. As the Mediterranean diet scale scores increased, BMI value, depression, anxiety and stress scale scores decreased (Table 5).

The findings show parallel results with literature; the presence of chronical illness in the study's participants may be due to weight problems, anxiety, lack of access to specialists or the urge to continue bad eating habits. As a result, it is observed that obese individuals who follow a Mediterranean diet have a lower risk of depression, anxiety and stress. Likewise, the severity of obesity decreases significantly as compliance with the Mediterranean diet increases. The severity

of obesity and depression, anxiety and stress have a positive relationship, that is, mood disorders increase with the increase of BMI. In this study, individuals who adopted a Mediterranean diet had lower LDL cholesterol. The fact that adherence to the Mediterranean diet is associated with psychological factors and BMI is important in terms of increasing the belief that improvement can be achieved with diet before medication in cases such as obesity, depression, stress and anxiety. Human psychology can cause individuals to feel good or bad in today's society; weight can represent understanding of beauty, exclusion and acceptance. Likewise, our lifestyles, which cause us to encounter more depression, anxiety and stress, affect our view of life and our self-care. It is noteworthy that the concepts that are in such a close relationship with each other gather around a changeable factor such as nutrition. However, understanding the effect of many parameters, such as the ever-changing world, changing life and nutrition patterns, is important to clarify the effectiveness and reliability of the results found in this study; comparative studies are needed with individuals who have a larger sample and adopt different nutritional models.

Study Limitations

The main limitation is the small sample size, therefore not representing the general population; this is due to the uneven distribution by gender and Mediterranean diet scores. It may be useful to increase the number of studies examining how mood and diet quality affect each other mutually and conduct studies that reach large masses in order to provide a detailed approach to the subject. Another limitation is that there are some differences reflected in the results of each study due to the lack of a fixed cut-off point in similar types of scales measuring diet quality. Setting fixed cut-off points in scales for the Mediterranean diet could help to find more accurate results in terms of comparing more studies.

CONCLUSIONS

The findings of this study showed that there could be a potentially beneficial association in terms of reducing BMI and lowering depression, anxiety, and stress levels in people who ate a Mediterranean diet. The prevalence of depression was the highest in morbidly obese people with a Mediterranean Diet Score of 5 and below. It supports the idea that individuals' levels of depression can vary depending on dietary quality. In order to clearly observe the relationship of other psychological disorders with diet quality, we recommend that more studies with more participants be conducted. In addition, the fact that LDL cholesterol and total cholesterol levels decreased as the Mediterranean diet score increased confirms those who emphasise the importance of diet in terms of heart health. This is due to the influence of healthy food preferences such as the Mediterranean diet. However, we recommend long-term studies to see the positive effects of this condition in terms of heart disease.

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AUTHORSHIP

B.M. and N.K. designed the study. B.M. conceptualisation, investigation, directed data collection and analysed the data. B.M. wrote the article. P.S.K. edited the manuscript for intellectual content and provided critical comments on the manuscript.

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