



Effects of Adherence to the Mediterranean Diet on Depression, Anxiety, and Sleep Quality During the Covid-19 Pandemic in Turkey

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HIGHLIGHTS

- > It was determined that the proportion of individuals without depression was higher in the high level of Mediterranean type diet adherence group.
- > In the study, as the adherence to the Mediterranean type diet increased, anxiety and depression scores decreased and sleep quality increased.
- > It was found that a 1-point increase in dietary adherence decreased depression score by 3 units, anxiety score by 3.4 units, and sleep score by 1.4 units.

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ABSTRACT

The aim of this study was to examine the effects of the adherence levels of adults to the Mediterranean diet (MD) on depression, anxiety, and sleep quality during the COVID-19 pandemic. Participants attempted the questionnaire, Beck Anxiety Scale, Beck Depression Inventory, Pittsburgh Sleep Quality Scale (PSQI), and Mediterranean Diet Adherence Screener (MEDAS). The study was conducted with 1053 individuals who were not diagnosed with COVID-19. Negative significant correlations were found between the MEDAS scores and PSQI, Anxiety and depression scores ($p < 0.001$). Multiple linear regression models were created using univariate analyses performed separately with variables affecting depression, anxiety, and sleep scores. Accordingly, it was found that a 1-point increase in dietary adherence decreased depression score by 3 units, anxiety score by 3.4 units, and sleep score by 1.4 units ($p < 0.001$). Increasing adherence to Mediterranean-type nutrition has been found to be effective in increasing the quality of sleep and reducing depression and anxiety during the COVID-19 pandemic.

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1. Introduction

The SARS-CoV-2 virus and novel coronavirus disease (COVID-19) emerged in Wuhan, China in December 2019 and spread rapidly, affecting almost the entire world [1]. COVID-19 was announced as a global epidemic by the World Health Organization (WHO) on 11 March 2020 [2]. In several European and World countries, including Turkey, various practices such as hand hygiene, mask and disinfectant use, social distance rules, isolation, individual quarantine, and lockdown are still practiced by citizens and governments to control and prevent the rapidly and vigorously spreading virus [3].

Although the fear of contracting SARS-CoV-2 infection and death has a negative effect on individuals, home isolation and individual quarantine periods can further affect the psychology of individuals and may lead to the development of anxiety and deterioration of their mood by causing distress [4, 5]. In April 2020, an online survey of 1491 adults in Australia has found that anxiety, depression, and stress symptoms increased in individuals during the COVID-19 pandemic [6]. In another study conducted with 1106 physicians in Israel in March 2020, high levels of anxiety, low levels of endurance, mental fatigue, anxiety about being infected, and sleep disorders have been observed [7].

Some recent studies show that anxiety and depression are associated with an unhealthy lifestyle [6, 8]. In a study, individuals with anxiety and depression had low energy intake and high sugar consumption. In addition, it has been found that men with depression consume more saturated fat and fewer fruits and vegetables [9]. Especially, an unhealthy diet may delay the healing process of the disease while suppressing the immune system and preparing a suitable ground for the development of infectious diseases [10].

Conversely, a healthy, adequate, and balanced diet is effective both in boosting the immune system and in the treatment and prevention of behavioral health problems [11]. Therefore, it is particularly important that society is directed toward healthy eating and encouraged in this regard, especially during this period. Mediterranean-type diet (MD), which has a protective effect on several diseases such as diabetes, cardiovascular diseases, cancer, and obesity, is one of the healthiest diet models that have been associated with health protection and healthy aging in recent years [12, 13]. MD, which is mostly characterized by fruits and vegetables, fish, poultry, whole grain products, nuts, and olive oil, is believed to be effective on psychiatric disorders. In a randomized controlled clinical study with 152 adults, increased MD intake was found to be associated with lower depression scores ($p = 0.01$) [14]. In this context, it is believed that directing individuals toward a MD diet may be effective in protecting both their physical and mental health [11, 12].

The first case of COVID-19 in Turkey was observed on March 11, 2020 and has brought with it serious protective and preventive policies [15]. With the decrease in the number of new and existing cases of COVID-19, the restrictions were relaxed as of June 1 and the "New Normal" period was initiated [16]. In this new normal, currently, the number of daily new cases and deaths from COVID-19 in Turkey is

higher than that in the first wave, and Turkey ranks sixth in terms of the total number of cases worldwide [17, 18].

In this study, it was aimed to examine the effects of the adherence levels of adults to the Mediterranean diet (MD) on depression, anxiety, and sleep quality during the COVID-19 pandemic.

2. Materials and Methods

2.1. Study design and subjects

This cross-sectional descriptive study was completed with 1053 healthy adults aged 19–65 years who were not COVID-19 positive. In the study, data was collected through the Google Forms online survey; the survey link was shared with the participants via WhatsApp and Instagram social networks. Snowball sampling was used by asking participants to share the web link of the study with a large number of potential participants in the province of Istanbul [19].

2.2. Ethical approval

Ethics committee approval was obtained for the study from the İstanbul Okan University Health Sciences Research Ethics Committee, decision number 17, dated 11/11/2020. In accordance with the Helsinki Declaration, the voluntary consent form was read to the individuals who accepted to participate in the study and the consent of the participants was obtained.

2.3. Research instruments

Volunteer participants responded to the survey form, including demographic and general characteristics and physical activity habits, the Beck Anxiety Inventory to determine the symptoms of depression, the Beck Depression Inventory to determine the degree of these symptoms, the Pittsburgh Sleep Quality to determine sleep quality, and the Mediterranean diet Adherence Scale [Mediterranean Diet Adherence Screener (MEDAS)] to determine adherence to the Mediterranean diet. The measurement of the height and body weight of the participants was questioned based on their statements. The body mass index of the individuals was calculated by dividing body weight by the square meter of height [body weight (kg)/height² (m)]. The results were interpreted according to the WHO classification [20].

Beck Anxiety Scale was developed by Beck et al. [21]. Turkish adaptation of the scale was done by Ulusoy et al. [22] (Cronbach Alpha: 0.93). The 21 items on the scale were evaluated using a 4-point Likert type assessment [22]. It is considered that those who scored between 8 and 15 points in total have "mild," those who scored between 16 and 25 points have "moderate," and those who scored between 26 and 63 points have "severe" anxiety symptoms. The Turkish adaptation of the Beck Depression Inventory (BDI) developed by Beck et al. [23] was performed by Hisli [24], and the Cronbach's alpha value of the scale was between 0.86 and 0.81. Scores between 1 and 10 indicate normal; 11 and 16 indicate mild depression, 17 and 20 indicate borderline clinical depression, 21 and 30 indicate moderate depression, 31 and 40 indicate severe depression, and 40 and above indicate very severe depression [24].

Pittsburgh Sleep Quality Scale (PSQI), comprising 18 items for the scoring, was developed by Buysse et al. [25] and its validity and reliability study in our country was performed by Ağargün [26] (Cronbach Alpha: 0.80). The total PSQI score between 0 and 4 indicates good sleep quality and between 5 and 21 indicates poor sleep quality [26].

MEDAS, developed by Martínez-González et al. [27] and validated in Turkish population by Pehlivanoğlu et al. [28], is a scale comprising 14 questions. A total score of ≥ 7 indicates that the individual has an acceptable degree of adherence to the MD and that of ≥ 9 indicates that the individual has high adherence to the MD [28].

2.4. Statistical analysis

Because the sample size was sufficient, parametric methods were applied in line with the central limit theorem. Pearson's correlation coefficients were calculated to examine the linear correlation between the MEDAS score and depression, anxiety, and sleep scores. An independent *t*-test was used for comparing scale scores according to two independent groups, and a one-way analysis of variance was used for more than two groups. The Chi-Square test was used to examine the relationship between the MEDAS classification and depression, anxiety, and sleep classification. Multiple linear regression models were created with variables found effective on the scales using univariate analysis. The models obtained by the backward elimination method are expressed with regression coefficients and explanatory coefficients (R^2). The statistical significance level was considered as 0.05. The analysis of the data was done in SPSS 21 program.

3. Results and Discussion

The sociodemographic and general characteristics of the participants are presented in Table 1. A total of 1053 people, 735 male (69.8%) and 318 female (30.2%), participated in the study; 62.7% of the participants did not exercise regularly. The mean anxiety score of the participants was 12.55 points; mean depression score was 14.22 points; mean PSQI score was 7.64 points; mean MEDAS score was 7.27 points (not given in the table).

A significant correlation was found between adherence to MEDAS and sleep, depression, and anxiety ($p < 0.05$). The proportion of those who did not have anxiety was higher in those with high level of adherence to MEDAS. The proportion of individuals with severe anxiety was higher in the non-adherence group. It was determined that the proportion of individuals without depression was higher in the high level of adherence group. In all levels of depression severity, the proportion of the non-adherence group was higher (Table 2).

There was a strong negative correlation between the MEDAS score and PSQI and depression scores, and a strong negative linear correlation with anxiety. It was observed that as the PSQI, depression, and anxiety scores increase, the MEDAS scores decrease ($p < 0.05$) (Table 3).

Table 1 Socio-demographic characteristics of the individuals

	MEAN (Std. Dev.)	P
Age (Man)	27.49 (10.34)	<0.001
Age (Woman)	31.71 (13.71)	
Age (Total)	28.77 (11.62)	
	N= 1053	%
Sex		
Male	735	69.8
Female	318	30.2
Age group		
18 - 24	614	58.3
25 - 34	204	19.4
35 - 44	95	9.0
45 - 54	87	8.3
55 - 64	53	5.0
Marital Status		
Single	736	69.9
Married	317	30.1
Employment status		
Not working	143	13.6
Officer	117	11.1
Worker	194	18.4
Self-employment	49	4.7
Retired	40	3.8
Student	510	48.4
Education		
Primary school graduate	31	2.9
Middle school graduate	24	2.3
High school graduate	565	53.7
Undergraduate	356	33.8
Postgraduate	77	7.3
Perceived income		
Not enough	215	20.4
Just enough	518	49.2
More than needed	320	30.4

In univariate analyses, the variables affecting the depression score were determined to be sex, alcohol use, physical activity, income status, and MEDAS score. In the model created with these variables, it has been observed that income is less than and equal to expense, causing an increase in depression score, whereas an increase in MEDAS score reduces depression score. These variables explain 74.7% of depression ($p < 0.001$). The variables affecting anxiety were age, sex, marital status, alcohol use, physical activity, income status, and MEDAS score. In a model created with these variables, income less than and equal to expenses causes an increase in anxiety score, whereas being a woman, doing physical activity, being married, and an increase in MEDAS score leads to a decrease in anxiety score. The model created with these variables explains 61% of the anxiety score ($p < 0.001$). In univariate analyses, variables affecting the sleep score were sex, alcohol use, income status, and MEDAS score. In the model created with these variables, being a woman and an increase in MEDAS score cause a decrease in sleep score. The model created with these variables explains 71% of the sleep ($p < 0.001$) (Table 4).

Table 2 Distribution of PSQI, anxiety scores and depression scores according to Medas classification (Chi-square test)

		Medas						Total		P
		Low adherence		Moderate adherence		High adherence		n	%	
		n	%	n	%	n	%			
PSQI	Good	57	11.5	192	55.0	204	98.6	453	43.0	<0.001
	Bad	440	88.5	157	45.0	3	1.4	600	57.0	
Anxiety score	None	118	23.7	195	55.9	204	98.6	517	49.1	<0.001
	Mild	137	27.6	97	27.8	3	1.4	237	22.5	
	Medium	109	21.9	57	16.3	0	0.0	166	15.8	
	Severe	133	26.8	0	0.0	0	0.0	133	12.6	
Depression score	Normal	83	16.7	192	55.0	207	100.0	482	45.8	<0.001
	Mild mental disorder	142	28.6	49	14.0	0	0.0	191	18.1	
	Borderline clinical depression	26	5.2	108	30.9	0	0.0	134	12.7	
	Moderate depression	217	43.7	0	0.0	0	0.0	217	20.6	
	Severe depression	21	4.2	0	0.0	0	0.0	21	2.0	
	Very serious depression	8	1.6	0	0.0	0	0.0	8	0.8	

As the novel COVID-19 is rapidly spreading, it deeply affects societies and people and forces countries to make radical changes like individual protection, home isolations, and quarantines which may negatively affect mental and physical [3, 4].

Table 3 The relationship between MEDAS score and PSQI, anxiety and depression scores (Pearson correlation)

	PSQI score		Anxiety score		Depression score	
	r	P	r	P	r	P
MEDAS score	-0.842	<0.001	-0.771	<0.001	-0.863	<0.001

Because the higher the health status and motivation is kept, the better the immune system will be, these are powerful weapons to fight COVID-19 [29]. WHO defines health not

only as of the absence of disability but also as complete physical, mental, and social well-being [30]. It is believed that protecting mental and physical health too may be effective in reducing mortality and morbidity rates in these days of social restrictions [31].

Lifestyle modifications come first in the protection and maintenance of health. A healthy diet, adequate sleep, regular physical activity, and a lifestyle that is as free from stress as possible brings along a healthy age by preserving health [32]. Currently, one of the leading diet models in terms of healthy nutrition is the MD. In this study, the adherence of individuals to the MD was examined using the MEDAS scale. In this context, it was observed that most participants (47.2%) were non-adherent to the MD, and the lack of adherence decreased with increasing age ($p < 0.05$).

Table 4 The effect of MEDAS scores on depression, anxiety and sleep quality ($R^2: 0,710$ $p < 0,001$ Multiple linear regression)

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
Depression	(Constant)	35.488	0.484		73.383	<0.001
	Perceived income (Not enough)	0.954	0.415	0.041	2.300	0.022
	Perceived income (Just enough)	0.696	0.333	0.037	2.087	0.037
	MEDAS	-2.998	0.054	-0.861	-55.229	<0.001
$R^2: 0,747$ $p < 0,001$						
Anxiety	(Constant)	38.105	0.829		45.987	<0.001
	Gender (female)	-1.538	0.512	-0.059	-3.002	0.003
	Regular physical activity	-1.648	0.484	-0.066	-3.408	0.001
	Perceived income (Not enough)	1.363	0.676	0.046	2.015	0.044
	Perceived income (Just enough)	1.094	0.544	0.046	2.013	0.044
	Married	-1.540	0.518	-0.059	-2.973	0.003
MEDAS	-3.413	0.087	-0.759	-39.078	<0.001	
$R^2: 0,610$ $p < 0,001$						
PSQI	(Constant)	18.089	0.221		81.737	<0.001
	Gender (female)	-0.333	0.164	-0.034	-2.026	0.043
	MEDAS	-1.423	0.028	-0.839	-50.365	<0.001

Nutrition, exercise, and sleep are believed to have an effective role in the etiology, progression and treatment of mental disorders [33]. In a systemic review including 12 epidemiological studies, the relationship between diet and depression and mental health was examined. Accordingly, it has been observed that unhealthy diets negatively affect

mental health and increase depression [34]. In a study conducted with adolescents, a healthy diet has been found to reduce symptoms of depression [35]. In this study, it was observed that as compliance with a healthy diet increased, sleep quality increased; depression and anxiety decreased.

Anxiety and depression have been found to be associated with sleep disorders and insomnia. In a study conducted with 2762 individuals between the age of 19 and 62 years, it was observed that those with anxiety and depression had poor sleep quality scores [36]. In the present study, individuals had mild levels of mental depression and anxiety, and it was observed that as the nutritional adherence decreased, sleep quality decreased as well as scores of depression and anxiety increased. In our study, it was found that a 1–point increase in dietary adherence reduced the depression score by 3 units, anxiety score by 3.4 units, and sleep score by 1.4 units ($p < 0.001$).

4. Conclusion

To alleviate the mortality and morbidity burden of COVID-19, it is essential to have optimal health and encourage individuals to adopt a healthy lifestyle. Concordantly, it is crucial to prefer MD, to have quality and sufficient sleep, regularly perform the exercise, and relieve the mind from stress and negative thoughts. Therefore, it is thought that increasing the awareness level of society regarding healthy nutrition and lifestyle can yield positive results.

The limitations of the study include the fact that the majority of the study is between the ages of 18–24 and mostly gathered around men individuals, the collection of data based on declarations on online platforms due to pandemic conditions. On the other hand, the presence of significant relationships between Mediterranean type diet with depression, anxiety and sleep quality scales was accepted as the strength of the study. In addition, as we know, there is no other study on the subject that will reflect the situation in the COVID-19 period in Turkey.

In the study, there was no restriction regarding quarantine durations. Conversely, considering that COVID-19 will continue for a while, this study might shed light on future studies, may be evaluated for comparison in the pandemic period.

Declaration of Conflict of Interest

Authors declare that they have no conflict of interest with any person, institution, or company.

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