

Evaluation of Emotional State and Mediterranean Diet Adherence During the COVID-19 Pandemic: Butterfly Effect

Büşra Atabilen^{id}, Gamze Akbulut^{id}, Tevfik Koçak^{id}, Nilüfer Tek^{id}

Gazi University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Ankara, Türkiye.

Correspondence Author: Büşra Atabilen

E-mail: busra.atbln@hotmail.com

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ABSTRACT

Objective: The COVID-19 disease, which is caused by the SARS-CoV-2 infectious agent, is the last member of infectious diseases. Factors such as uncertainties about the prognosis of the disease, insufficient control measures, lack of effective therapeutic mechanisms can cause negative effects on individuals' daily living activities and mental health. In this study, it was aimed to evaluate the mood changes and Mediterranean diet adherence of individuals during the COVID-19 pandemic.

Methods: The study was carried out between November 2020 and January 2021 with individuals over 18 years of age. The data required for the research were collected with an online questionnaire. The COVID-19 Phobia Scale (C19P-S) and the Coronavirus Anxiety Scale (CAS) were used to assess the emotional state of individuals. The Mediterranean Diet Adherence Screener (MEDAS) was used to examine the adherence to the Mediterranean diet.

Results: A total of 6609 individuals between the ages of 18-70 participated in the study and 70% of the participants are female. The median score obtained from the C19P-S in female individuals was found to be significantly higher than in male subjects ($p < 0.001$). A positive relationship was shown between the Mediterranean diet adherence and the COVID-19 Phobia Scale ($p < 0.001$).

Conclusion: The COVID-19 related phobia and fear may have positively affected the adherence to the Mediterranean diet of individuals as a coping strategy with this pandemic period.

Keywords: COVID-19 pandemic, Emotional state, Mediterranean diet, Phobia, Anxiety

1. INTRODUCTION

Throughout history, infectious diseases have had devastating effects on societies. Especially in recent years, globalization has facilitated the spread of pathological agents, leading to worldwide pandemics. Considering the last two decades of infectious diseases, it is known that coronavirus-related diseases (SARS and MERS) have emerged and these diseases have caused great damage to public health systems. The COVID-19 disease, which is caused by the SARS-CoV-2 infectious agent, is the last member of these pandemics (1). COVID-19, which was identified in China at the end of 2019, is a disease with a high spread potential and its incidence is increasing exponentially. Factors such as uncertainties about the prognosis of the disease, insufficient control measures, lack of effective therapeutic mechanisms, public health measures that violate personal freedoms and economic burden can cause negative effects on individuals' daily living activities and mental health (2, 3). Psychologists and mental health experts predict that the pandemic will adversely affect the mental health of the population globally, with increases in depression, suicide and self-harm cases (4, 5).

Although the determinants of mental health are complex, one of the most important factors is nutrition. Epidemiological data emphasise the relationship between nutrition and mental health, but don't ensure sufficient information about causality or mechanisms (6). Especially the Mediterranean diet can be recommended as a therapeutic approach strategy to control the inflammatory and prothrombotic process during the COVID-19 pandemic (7). It is known that the Mediterranean diet can also have positive effects on mental health (8). In terms of nutritional pattern, the Mediterranean diet is low in saturated fat and animal protein; rich in antioxidants, fiber and monounsaturated fatty acids and provides an adequate balance of omega-6/omega-3 fatty acids. That's why the Mediterranean Diet is currently recognized as one of the healthiest eating patterns worldwide (9). In this study, it was aimed to examine the emotional changes and Mediterranean diet adherence of individuals during the COVID-19 pandemic.

2. METHODS

2.1. Data Collection

Research data were collected with an online questionnaire (Google Form) applied to individuals over the age of 18 between November 2020 and January 2021, through snowball sampling, including samples from different cities of Turkey. As a result of the power analysis using the Minitab program; A total of at least 5088 samples were found to be sufficient with 80% power and 5% margin of error. The questionnaire includes demographic information, statement of health (disease state diagnosed by the physician, COVID-19 diagnosis status) and anthropometric measurements (body weight, height), COVID-19 Phobia Scale (C19P-S) and the Coronavirus Anxiety Scale (CAS), and the 14-item Mediterranean Diet Adherence Screener (MEDAS). Ethical approval was obtained from the Gazi University Ethics Committee as a result of the meeting decision dated 16.02.2021 and numbered 03, with the research code 2021-212. Written informed consent was obtained from all subjects.

2.2. Mediterranean Diet Adherence Screener (MEDAS)

In the study, the Mediterranean Diet Adherence Screener (MEDAS) was used to evaluate the participants' adherence to the Mediterranean diet. The Mediterranean Diet Adherence Screener was developed by Martinez-Gonzalez et al (10). The scale consists of 14 questions in total, those who answer "Yes" to the questions get 1 point, and those who answer "No" get 0 points. The highest score that can be obtained from the scale is 14. The total score obtained from the scale is evaluated as ≤ 5 (low adherence), 6-9 (moderate adherence), and ≥ 10 (high adherence) (10). Turkish validation and reliability of Mediterranean Diet Adherence Screener was made by Pehlivanoglu et al (11).

2.3. COVID-19 Phobia Scale (C19P-S)

Developed by Arpacı et al. (12), COVID-19 Phobia Scale is a 20-item self-report tool that addresses the phobia diagnostic criteria of the DSM-V. Initial tests performed in relation to the scale show that the scale has construct, convergent and discriminant validity, and internal consistency reliability. However, further testing of the scale is needed. Items on a five-point Likert-type scale is graded between "strongly disagree" and "strongly agree". The score obtained from the scale can vary between 20 and 100. A higher score on the scale shows a greater phobia (12).

2.4. Coronavirus Anxiety Scale (CAS)

Coronavirus Anxiety Scale (CAS) was developed by Sherman Lee (13) to determine possible dysfunctional anxiety related to the COVID-19 pandemic. The scale consists of 5 questions, the answers to the scale are determined as "Never (0)", "Rarely, less than one or two days (1)", "A few days (2)",

"More than 7 days (4)" and "Almost every day in the last two weeks (5)". Coronavirus Anxiety Scale distinguishes between individuals with and without dysfunctional anxiety using a cut-off score of ≥ 9 (13). Turkish validation and reliability of Coronavirus Anxiety Scale was made by Evren et al. (14).

2.5. Statistical Analysis

The data obtained from the questionnaires were analyzed with appropriate statistical methods using the SPSS 22.0 program (15). Descriptive values are shown as number (n), percent (%), arithmetic mean (\bar{x}), and standard deviation (ss). Pearson chi-square test was used to compare categorical variables. The conformity of the variables to normality was examined by visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). Mann-Whitney U test and Kruskal-Wallis test were used to compare data that did not have normal distribution. Multivariate regression analysis was performed to predict the Mediterranean diet adherence by using age, body mass index (BMI), CAS and C19P-S. Statistical significance level was determined as $p < 0.05$.

3. RESULTS

This study, whose data were collected using an online questionnaire, was carried out with 6609 individuals between the ages of 18-70. Approximately 70% of the individuals participating in the study are female (69.8%). When the demographic data were analyzed, it was found that the median age of male individuals was significantly higher than female individuals ($p < 0.001$). According to education level, more than 70% of male and female individuals are university graduates and this rate is significantly higher for females than for males ($p < 0.001$). According to the working status, the ratio of working male individuals (43.8%) was found to be significantly higher than female individuals (23.1%) ($p < 0.001$). The median BMI in male individuals was significantly higher than female individuals ($p < 0.001$). However, the BMI value for individuals in both groups can be classified as normal according to the World Health Organization cut-off values (16). Data on demographic and health information are given in Table 1.

The Mediterranean diet adherence profile of the individuals is shown in Figure 1. Of the participants, 61% are in the group that moderately adheres to the Mediterranean diet. More than half of the individuals (57.8%) use only olive oil in their meals. While the rate of those who consume two servings or more of vegetables a day is close to 70%, the rate of those consuming three servings or more of fruit per day remained at 25%. The rate of those who consume less than one serving of red meat and processed meat products, butter and sugar-sweetened beverages per day constitutes 75%. However, according to the Mediterranean diet adherence profile, the consumption rate of three servings or more of legumes (34.1%), fish and seafood (15%) and nuts (30.8%) per week is low.

Table 1. Demographic characteristics, health data and anthropometric measurements of individuals

Demographic and health characteristics	Male (n=1995)		Female (n=4614)		Z/ χ^2	p
	n	%	n	%		
Age (year)						
Median [Interquartile range (IQR)]	23.0 [9.0]		22.0 [8.0]		-6.150	<0.001*
Range	52.0		52.0			
Min-max	18-70		18-70			
Educational status						
Literate	15	0.8	43	0.9	22.611	<0.001†
Primary school	36	1.8	139	3.0		
Secondary school	56	2.8	141	3.1		
High school	350	17.5	718	15.6		
University	1431	71.7	3405	73.8		
Postgraduate	107	5.4	168	3.6		
Working status						
Working	873	43.8	1067	23.1	285.958	<0.001†
Not working	1122	56.2	3547	76.9		
Marital status						
Married	1505	75.4	1160	25.1	0.250	0.617†
Single	490	24.6	3454	74.9		
Living place						
Urban	1587	79.5	3620	78.5	3.381	0.184†
Rural	407	20.5	994	21.5		
Chronic disease diagnosis status						
Yes	215	10.8	795	17.2	44.800	<0.001†
No	1780	89.2	3819	82.8		
COVID-19 diagnosis status						
Yes	226	11.3	476	10.3	1.502	0.220†
No	1769	88.7	4138	89.7		
Anthropometric measurements						
Height (cm)						
Median [Interquartile range (IQR)]	178 [8]		164 [8]		-56.550	<0.001*
Range	67		43			
Min-max	140-207		145-188			
Body weight (kg)						
Median [Interquartile range (IQR)]	77 [16]		59 [14]		-46.336	<0.001*
Range	117		131			
Min-max	43-160		37-168			
BMI (kg/m²)						
Median [Interquartile range (IQR)]	24.4 [4.68]		21.8 [5.08]		-23.602	<0.001*
Range	35.8		48.1			
Min-max	16.2-52.0		14.4-62.5			

*Mann-Whitney U test

†Pearson Chi-square test

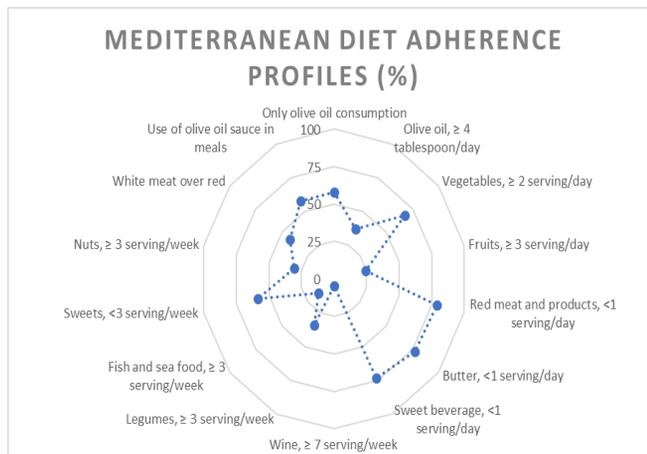


Figure 1. Radar graph of Mediterranean diet adherence profile

Table 2 shows the distribution of Mediterranean Diet Adherence Screener, Coronavirus Anxiety Scale, and COVID-19 Phobia Scale classification by sex. According to the Mediterranean diet adherence scale classification, 52.8% of male individuals and 64.6% of female individuals show moderate adherence. The ratio of females who moderately and highly adherence to the Mediterranean diet is significantly higher than that of males ($p < 0.001$). Similarly, the median score of the C19P-S in females was found to be significantly higher than in male subjects ($p < 0.001$).

In Table 3, the relationship between the Mediterranean Diet Adherence Screener classification, the CAS, and the C19P-S was evaluated. The median score of C19P-S of individuals with low adherence to the Mediterranean diet was significantly lower than those with moderate adherence ($p < 0.001$). Likewise, the C19P-S median score of individuals with low adherence was significantly lower than those with high adherence ($p < 0.001$).

In the study, multivariate regression analysis was performed to predict the Mediterranean diet adherence by using age, BMI, CAS and C19P-S variables. In the first model of multivariate regression analysis, only the CAS and C19P-S variables were used; in the second model, age and BMI variables were also included. As a result of the analysis, significant results were obtained for both models. For Model 1, $F(2, 6606) = 28.46, p < 0.001$, and the C19P-S positively and significantly predict adherence to the Mediterranean diet. For Model 2, $F(4, 6604) = 23.07, p < 0.001$, and although C19P-S and age predicted adherence to Mediterranean diet positively and significantly; BMI predicted negatively and significantly (Table 4).

Table 2. Distribution of Mediterranean Diet Adherence Screener, Coronavirus Anxiety Scale, and COVID-19 Phobia Scale classification by sex

	Male (n=1995)		Female (n=4614)		Z/X ²	p
	n	%	n	%		
Mediterranean Diet Adherence Screener classification						
≤5 (low adherence)	774	38.8	1214	26.3	104.548	<0.001*
6-9 (moderate adherence)	1054	52.8	2980	64.6		
≥10 (high adherence)	167	8.4	420	9.1		
Coronavirus Anxiety Scale (CAS) classification						
<9 (normal)	1935	97	4504	97.6	2.160	0.142*
≥9 (dysfunctional anxiety)	60	3	110	2.4		
COVID-19 Phobia Scale (CP19-S)						
Median [Interquartile range (IQR)]	46 [15]		49 [15]		-12.328	<0.001 [†]
Range	57		62			
Min-max	25-82		27-89			

*Pearson Chi-square test

[†]Mann-Whitney U test

Table 3. Relationship between Mediterranean Diet Adherence Screener classification, Coronavirus Anxiety Scale and COVID-19 Phobia Scale

	Mediterranean Diet Adherence Screener classification						X ²	p
	Low adherence		Medium adherence		High adherence			
Coronavirus Anxiety Scale (CAS) classification								
<9 (normal)	1937	97.4	3938	97.6	564	96.1	4.840	0.089 *
≥9 (dysfunctional anxiety)	51	2.6	96	2.4	23	3.9		
COVID-19 Phobia Scale (CP19-S)								
Median [Interquartile range (IQR)]	47 [15]		49 [14]		50 [16]		41.225	<0,001 [†]
Range	58		59		62			
Min-max	25-83		27-86		27-89			

* Pearson Chi-Square test

[†] Kruskal-Wallis test

(According to Post Hoc Bonferroni correction, there is a significant difference between low adherence and medium adherence; low adherence and high adherence.)

Table 4. Multiple regression analysis of independent variables affecting adherence to the Mediterranean diet

Variables	Non-standard coefficients		Standard coefficients	R	R ²	t	p
	B	Standard error	Beta				
Model 1							
Constant	5.585	0.137	-			40.859	<0.001
COVID-19 Phobia Scale (CP19-S)	0.021	0.003	0.100	0.008	0.009	7.413	<0.001
Coronavirus Anxiety Scale (CAS)	-0.022	0.012	-0.026			-1.897	0.058
Model 2							
Constant	5.647	0.200	-			28.288	<0.001
COVID-19 Phobia Scale (CP19-S)	0.020	0.003	0.096			7.127	<0.001
Coronavirus Anxiety Scale (CAS)	-0.021	0.012	-0.024	0.013	0.014	-1.805	0.071
Age	0.018	0.003	0.082			5.913	<0.001
Body Mass Index (BMI)	-0.022	0.007	-0.042			-3.021	0.003

4. DISCUSSION

In this study, which aims to evaluate the mood changes of individuals and their adaptation to the Mediterranean diet during the Covid-19 pandemic, it was concluded that older age, low body mass index and high COVID-19 phobia significantly affect the adaptation to the Mediterranean diet.

COVID-19 pandemic is associated with a variety of mental and psychological complications and it is a condition that negatively affects health and social systems, with a high rate of contamination, morbidity and mortality (7, 17). Although there is no diet to prevent coronavirus and there are limited clinical nutrition protocols for COVID-19 patients, the Mediterranean diet is recommended as a healthy diet model to control inflammation and thrombosis accompanying complications (18). In an ecological study conducted in Spain and 23 member countries of the Organization for Economic Cooperation and Development (OECD), adherence to the Mediterranean diet was shown to be negatively associated with COVID-19 cases and COVID-19 death rates (19). Similarly, in another study, the risk of developing COVID-19 was found to be significantly lower in individuals with moderate adherence to the Mediterranean diet (20). Therefore, adherence to the Mediterranean diet may be promising for conditions predisposing to COVID-19 infection and COVID-19 complications during the pandemic period (7). In studies examining the change in dietary habits of individuals during the pandemic period, it has been reported that individuals generally adhere to the Mediterranean diet moderately (21-23). In our study, it was found that 61% of individuals moderately adhered to the Mediterranean diet.

In addition, the proportion of females who moderately and highly adhered to the Mediterranean diet is significantly higher than males ($p < 0.001$). Similar to our study, in a study conducted with the data obtained from the COVIDiet study, it was reported that the participants with a higher adherence to the Mediterranean diet were mostly female (88.8%) and had a higher education level (66.3%) (24). However, there are also studies showing that men's adherence to the Mediterranean diet is significantly higher than that of women (25, 26). In our study, the reason for the higher rate of adherence to the Mediterranean diet in female individuals may be the significantly higher education level of females than males ($p < 0.001$). In addition, the fact that the ratio of working male individuals is significantly higher than female individuals ($p < 0.001$) may be a factor affecting food consumption outside and reducing adherence to the Mediterranean diet. Alternatively, the fact that the rate of female individuals diagnosed with chronic disease is higher than male individuals are ($p < 0.001$) may be related to a healthier change in eating habits of female individuals after the diagnosis of the disease.

Although the whole world acted quickly and in cooperation to control the spread of the virus that caused the COVID-19 pandemic, it was not easy to control this situation, which adversely affected human life around the world. Thus, this process not only affected all activities, but also had a tremendous negative impact on the mental health of individuals. In a study evaluating depression, anxiety, stress and sleep problems in the first seven months of the COVID-19 pandemic, the prevalence of depression was recorded as 20%, anxiety 35% and stress 53% (27). Similarly, other studies have reported anxiety and depression symptoms and self-reported stress as common psychological responses to the COVID-19 pandemic (28-30). However, in our study, 97.4% of individuals were classified as normal according to Coronavirus Anxiety Scale. When the mean scores from the C19P-S were evaluated, it was shown that female individuals (50.4 ± 10.63) had a significantly higher mean score than male individuals (46.9 ± 9.94) ($p < 0.001$). A higher level of COVID-19 phobia in women has also been reported in previous similar studies in Turkey (31, 32) and Iran (33). In this process, there may be many factors that can affect the mental health of individuals. Living alone, low education level, living place (urban or rural area), previous medical condition, poor sleep quality, previous events that may increase the stress load can be counted among these factors (34). The fact that 75% of female individuals were single and higher rate of disease diagnosed in females than males in our study may explain the higher mean score obtained from the C19P-S in females.

Another remarkable result we obtained from the study is that the factors affecting the adherence of individuals to the Mediterranean diet are age, BMI and CP19-S according to the multiple regression analysis model. The mean score from the CP19-S was significantly higher in patients with high adherence to the Mediterranean diet screener (50.6 ± 10.98) than those with low adherence (48.2 ± 10.67). Unlike our study, in an international cross-sectional study conducted

online, the majority of participants (54%) reported at least mild anxiety during the pandemic, while 25% reported moderate or severe anxiety. In addition, in the logistic regression analysis model, which includes individuals with at least moderate anxiety, after controlling for age, gender and other variables, Mediterranean diet score reduced the rate of increased anxiety (OR 0.92, 95% CI 0.89–0.95, $p < 0.0001$) (35). Similarly, individuals with high adherence to the Mediterranean diet were found to have lower rates of depression, anxiety, and psychological distress than those with low adherence (36). In addition, other studies reported a positive relationship between anxiety level and consumption of sugar-sweetened beverage ($p = 0.013$), fast food ($p < 0.001$) and pastry food ($p < 0.001$) during the COVID-19 pandemic period (37), and food with high energy content increased consumption was found (38). There is also a study showing that an increase in COVID-19 phobia is associated with a decrease in eating awareness (39). The reason for finding different results from the literature in our study may be that the increased level of phobia and fear against COVID-19 has led individuals to adopt healthier eating habits. In addition, with the increase in the time spent at home in this period, adaptive coping strategies with COVID-19 such as more fruit and vegetable consumption, insecurity against out-of-home food consumption, and increase in home food consumption (38, 40) are associated with the fact that individuals' dietary habits has become more suitable for Mediterranean diet.

The strength of the research is that the results are generalizable because the number of participants is high and it includes different cities in Turkey. However, due to the fact that the study was performed online, cross-checking could not be achieved by taking the food consumption records of the individuals as well as the scale results in the evaluation of compliance with the Mediterranean diet.

5. CONCLUSION

Consequently, in this study aiming to evaluate the emotional change and Mediterranean diet adherence of individuals during the COVID-19 pandemic period, it was found that the Mediterranean diet adherence rate of female individuals was higher than male individuals. While the majority of individuals are classified as normal according to the CAS, according to the C19P-S, the mean score of female individuals from the scale was found to be significantly higher than that of male individuals. In addition, the mean scores of the CP19-S were found to be significantly higher in those with a high adherence rate for the Mediterranean diet. This situation has been evaluated as a coping strategy compatible with this process, as the fear and phobia of the coronavirus lead individuals to healthier eating habits. The Mediterranean diet is a healthy eating model that has protective features from many diseases. In this period, when emotional state changes and mental health is negatively affected, adherence to Mediterranean diet is important in getting through the pandemic period in a healthier way both physically and mentally.

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Design of the study: BA, GA, TK, NT

Acquisition of data for the study: BA, GA, TK, NT

Analysis of data for the study: BA, GA, TK, NT

Interpretation of data for the study: BA, GA, TK, NT

Drafting the manuscript: BA, GA

Revising it critically for important intellectual content: BA, GA, TK, NT

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