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THE RELATIONSHIP BETWEEN BRAIN FOG LEVELS IN INDIVIDUALS WITH COVID-19 AND MEDITERRANEAN DIET: A CROSS-SECTIONAL STUDY

COVID-19'LU BİREYLERİN BEYİN SİSİ DÜZEYLERİ İLE AKDENİZ DİYETİ ARASINDAKİ İLİŞKİ: KESİTSEL ÇALIŞMA

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ABSTRACT

Objective: Post-illness complications are observed in individuals who have had a COVID-19 infection. Although many recover without lasting effects, some continue to experience cognitive impairments. A common symptom observed in many patients following COVID-19 infection is brain fog. The Mediterranean diet is effective in improving brain functions. The primary aim of this cross-sectional study is to examine the potential relationship between the severity of brain fog and adherence to the Mediterranean diet.

Methods: A total of 314 individuals diagnosed with COVID-19 at Zonguldak Atatürk State Hospital between 2020 and 2022 were included in this study. The study was conducted between April and June 2024 with individuals aged 19 to 65. Participants were surveyed via telephone interviews, and data on sociodemographic characteristics, dietary habits, and anthropometric measurements were collected. They also completed the Brain Fog Scale (30 items, three dimensions; cognitive symptoms: 17–85, physical symptoms: 8–40, psychological symptoms: 5–25, total score: 30–150) and the Mediterranean Diet Quality Index (≤5: low adherence; 6–9: moderate adherence; ≥9: high adherence).

Results: The average Mediterranean diet quality score was 4.9±2.3 for women and 4.2±2.1 for men (p=0.04). The majority of participants (67.8%) had a low Mediterranean diet score. The average Brain Fog Scale scores were 34.5±10.7 for cognitive symptoms, 18.8±6.9 for physical symptoms, and 9.7±4.1 for psychological symptoms. A significant negative correlation was found between physical symptom scores and Mediterranean diet quality scores (r=-0.169; p=0.001).

Conclusion: Lifestyle and dietary habits appear to play an important role in alleviating brain fog symptoms observed in the post-COVID-19 period. In this context, improving adherence to the Mediterranean diet may contribute particularly to the reduction of physical symptoms.

Keywords: Brain Fog, Cognitive Symptoms, COVID-19, Mediterranean Diet, Physical Symptoms, Psychological Symptoms

ÖZET

Amaç: COVID-19 enfeksiyonu geçiren bireylerde hastalık sonrası komplikasyonlar görülmektedir. Birçok kişi kalıcı sonuçlar olmaksızın iyileşse de bilişsel yetersizlikler yaşamaya devam etmektedir. COVID-19 enfeksiyonunu takiben birçok hastada beyin sisi gözlemlenmektedir. Akdeniz diyeti, beyin fonksiyonlarını iyileştirmekte etkilidir. Bu kesitsel çalışmanın temel amacı, beyin sisi şiddeti ile Akdeniz diyeti uyumu arasındaki potansiyel ilişkiyi incelemektir

Gereç ve Yöntem: Bu çalışmaya, 2020 ile 2022 yılları arasında Zonguldak Atatürk Devlet Hastanesi'nde COVID-19 tanısı almış 314 birey dahil edilmiştir. Çalışma, Nisan-Haziran 2024 tarihleri arasında 19-65 yaş arası bireylerle yürütülmüştür. Katılımcılara telefon görüşmesi aracılığıyla anket uygulanmış ve sosyodemografik özellikler, beslenme alışkanlıkları, antropometrik ölçümler ile birlikte Beyin Sisi Ölçeği (30 madde, üç boyut; bilişsel semptomlar: 17-85, fiziksel semptomlar: 8-40, psikolojik semptomlar: 5-25, toplam puan: 30-150) ve Akdeniz Diyeti Kalite İndeksi (≤5: düşük uyum; 6-9: orta düzeyde uyum; ≥9: yüksek uyum) soruları yöneltilmiştir.

Bulgular: Kadınların Akdeniz diyet kalite puanı ortalaması 4,9±2,3, erkeklerin ise 4,2±2,1 olarak bulunmuştur (p=0,04). Katılımcıların çoğunluğu (%67,8) düşük düzeyde Akdeniz diyet puanına sahiptir. Katılımcıların Beyin Sisi Ölçeği ortalama puanları; bilişsel semptomlar için 34,5±10,7, fiziksel semptomlar için 18,8±6,9 ve psikolojik semptomlar için 9,7±4,1 olarak saptanmıştır. Fiziksel semptom puanları ile Akdeniz diyet kalite puanı arasında anlamlı negatif bir korelasyon bulunmuştur (r=-0,169; p=0,001).

Sonuç: COVID-19 sonrası dönemde görülen beyin sisi semptomlarının hafifletilmesinde yaşam tarzı ve beslenme alışkanlıklarının önemli bir rolü olabileceği görülmektedir. Bu bağlamda, Akdeniz diyetine uyumun artırılması, özellikle fiziksel semptomların azaltılmasına katkı sağlayabilir.

Anahtar Kelimeler: Akdeniz Diyeti, Beyin Sisi, Bilişsel Semptom, COVID-19, Fiziksel Semptom, Psikolojik Semptom

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INTRODUCTION

Coronavirus Disease 2019 (COVID-19), which is a severe respiratory disease caused by the SARS-CoV-2 virus, was seen for the first time in China in December 2019. As it spread fast to the rest of the world, the World Health Organization (WHO) (Carey et al.,2024) declared it on 11 March 2020. The COVID-19 pandemic substantially affected the lives of millions of people worldwide. COVID-19 has potential outcomes known as post-acute sequelae of SARS-CoV-2 infection (PASC), which are also named long COVID or post-COVID-19 conditions by the National Institutes of Health (NIH) (Mazza et al.,2021). Many individuals experience persistent symptoms such as respiratory and neuropsychiatric conditions in this process known as 'long COVID'. Long-term symptoms were reported as cognitive impairment, fatigue, concentration difficulties, mood changes, and sleep problems (Ishikura et al.,2023). Cognitive impairments can have devastating effects on day-to-day functionality. Increasing evidence shows that individuals who have experienced COVID-19 infection have a high risk of developing long-term neurological complications. 'Brain fog' is one of these complications (Chasco et al.,2022).

Brain fog is defined as a concept involving challenges such as cognitive impairment, concentration problems, mental fatigue, sleep problems, and anxiety (Melzer et al.,2021). Brain fog affects the daily lives of individuals who have recovered from COVID-19 to a substantial extent and reduces their quality of life (Serra-Majem et al.,2020). Dieting and lifestyle help prevent or delay the emergence of diseases and support quality of life through the consumption of certain types of foods. WHO emphasizes the importance of diet in the prevention of diseases, protection from them, and their treatment (WHO,2015).

The underlying mechanisms of long COVID have not been completely understood yet. It is assumed that inflammation plays an important role in the development of long COVID via a few complex pathways. The management of this condition depends on the symptoms and needs of the patient. Dietary regulation and physical rehabilitation are recommended for treating long COVID and improving quality of life (Dietz & Brondstater, 2024). The Mediterranean diet has been adopted due to its health-promoting effects, particularly its antioxidant and anti-inflammatory properties, making it a promising nutritional approach for various health conditions, including post-COVID-19 syndrome (Barrea et al.,2022). The Mediterranean diet is characterized by the consumption of high amounts of unrefined grains, fruits, vegetables, legumes, and olive oil, moderate amounts of alcohol, and low amounts of meat products. These dietary habits offer protective functions due to their anti-inflammatory and antioxidant effects, which stem from the rich content of monounsaturated fatty acids (MUFAs) in olive oil, polyunsaturated fatty acids (PUFAs) in fish, and various antioxidants in fruits, legumes, vegetables, and wine (Mazza et al.,2021). These bioactive compounds in the Mediterranean diet reduce oxidative stress and inflammation in cells. Adherence to the Mediterranean diet is associated with a lower incidence of obesity, cancer, cardiovascular diseases, and metabolic diseases (Tuttolomondo et al.,2019). In a study on inflammation markers in cancer patients, individuals who did not adopt the Mediterranean diet had higher C-reactive protein (CRP) levels in comparison to those who adopted this diet (Onder & Seremet- Kurklu,2023). In studies conducted within the last decade on the relationship between the Mediterranean diet and the risk or incidence of cancer, it has been revealed that this diet can be a determining factor at earlier stages of cancer. This diet was identified as a protective factor against cancer due to its high consumption of olive oil, as well as fruits and vegetables recommended to be consumed in season, which is associated with higher intake of antioxidants, anti-inflammatory substances, and fiber in these food items (Mazza et al.,2021). For this reason, the Mediterranean diet may have potential in the prevention or treatment of long COVID as a nutritional approach. Previously reported effects of the Mediterranean diet show that it can reduce inflammation, and consuming foods rich in omega-3 fatty acids leads to improvements in cognitive functions. The Mediterranean diet also prevents oxidative stress because it includes foods with low glycemic index values (Onder & Seremet-Kurklu,2023). In a study that included the Mediterranean Diet Adherence Screener (MEDAS) to evaluate this parameter in 49 chronic obstructive pulmonary disease (COPD) patients, it was determined that patients who had high levels of adherence to the Mediterranean diet had a lower risk of developing cognitive impairment (Chasco et al.,2022).

In this study, it was to investigate the relationship between the brain fog levels of individuals who had recovered from COVID-19 and their adherence to the Mediterranean diet.

MATERIALS AND METHODS

Population

This cross-sectional study was carried out with 314 individuals aged 18-65 who were diagnosed with COVID-19 at Atatürk Hospital in Zonguldak between March 2020 and September 2022 and agreed to participate in the study.

After obtaining verbal consent from individuals who agreed to participate in the study, data collection forms were filled out by holding telephone interviews with the participants in a quiet environment that would allow their responses to be heard clearly.

Inclusion Criteria:

- Agreeing to participate in the study,
- Having been diagnosed with COVID-19 via a SARS-CoV-2 PCR test at Zonguldak Atatürk State Hospital.

Exclusion Criteria:

- Having a preexisting comorbidity that could affect the results (e.g., dementia or other serious neurodegenerative diseases, previous cerebrovascular events, epilepsy or seizures, traumatic brain injury accompanied by loss of consciousness, and recent diagnosis of cancer involving chemotherapy or radiotherapy),
- Not being able to speak Turkish,
- Living in nursing homes or assisted living facilities.

Study design and data collection

The participants were asked questions about their general characteristics (age, sex, education status, income status, and place of residence), anthropometric measurements (height and weight), health-related characteristics (diagnosed diseases, medication usage status, vitamin-mineral usage status, time of COVID-19 diagnosis, COVID-19 vaccination status, and COVID-19 treatment process), and dietary habits (frequency of meals, status of skipping meals, frequency of eating outside, and type of food eaten outside). The participants were also administered the Brain Fog Scale (BFS) and the MEDAS.

Brain Fog Scale (BFS)

BFS is a scale that was developed to assess the cognitive, physical, and psychological symptoms of brain fog, and it was adapted into Turkish by Atik and Manav in 2023. Cronbach's alpha, Spearman-Brown, and Guttman internal consistency coefficients of the overall scale and all its subscales were reported to be higher than 0.70. It is a valid and reliable scale that can be applied in Turkish society. BFS consists of 30 items and three subscales, and its total score varies in the range of 30-150. The scores of its subscales vary in the ranges of 17-85 for cognitive symptoms (items about forgetfulness, intellectual impairment, concentration, attention deficit, etc.), 8-40 for physical symptoms (items about sleepiness, malaise, reduction in task performance skills, etc.), and 5-25 for psychological symptoms (items about difficulty in communicating, worry, emotional control, etc.). Higher scale or subscale scores indicate higher levels of brain fog severity.

Mediterranean Diet Adherence Screener (MEDAS)

MEDAS was developed by Martinez-Gonzalez et al. (2012) to assess adherence to the Mediterranean diet. It was later tested for validity and reliability in Turkish by Pehlivanoglu et al. (2020), and has a score range of 0–14. The scale questions the use of olive oil as the main oil in foods and the consumption frequency and amounts of items including olive oil, vegetables, fruits, red/processed meats, butter, cream, margarine, soda drinks, wine, legumes, fish/seafood, and commercial sweets and confectionery. It consists of a total of 14 items, including two about dietary habits and 12 about consumption frequencies. Each item is scored "0" or "1" based on its content, and item scores are added together to obtain a total score. MEDAS scores are rated as follows: ≤5=low adherence, 6-9=medium adherence, and ≥9=high adherence. Cronbach's alpha coefficient of the scale was reported as 0.829.

Anthropometric measurements

The height (cm) and weight (kg) information of the participants was collected based on their self-reports. The body mass index (BMI) value of each participant was calculated using their height and weight with

the formula: BMI=weight (kg) / (height (m)) ². According to the BMI classification of WHO, individuals with BMI values below 18.50 kg/m² are underweight, those with values in the range of 18.50-24.99 kg/m² are of normal weight, those with values in the range of 25.0-29.99 kg/m² are pre-obese, those with values in the range of 30.00-34.99 kg/m² are obese class I, those with values in the range of 35.00-39.99 kg/m² are obese class II, and those with values above 40.00 kg/m² are obese class III (WHO, 2010).

Ethical approval

Institutional permission was obtained from the hospital where the study was carried out, and ethical approval was received from Halic University, Non-Invasive Clinical Studies Ethics Committee (decision no: 2024/01).

Statistical analysis

After collecting the data, it was analyzed in the Windows environment using the SPSS (Statistical Package for the Social Sciences) Statistics 15.0 statistical package program. Descriptive statistics of the variables are presented in tables as mean ($\bar{x}$), standard deviation (SD), minimum, maximum, and percentage (%) values. Before the statistical analyses, normal distribution assumptions were tested using the Kolmogorov-Smirnov test. Scale scores and descriptive characteristics were compared between two independent groups using the Mann-Whitney U test and between more than two independent groups using the Kruskal-Wallis test. Post hoc Bonferroni tests were carried out to identify the source of significant differences. The error margin was accepted as 0.05.

RESULTS

Descriptive characteristics

The sample of the study consisted of 314 individuals, including 178 women and 136 men. The mean ages of the female and male participants were 38.78±10.02 and 41.39±11.11, respectively. The mean BMI of the participants was 26.1±4.2 kg/m^2. The mean BMI values of the female and male participants were 25.22±4.4 kg/m^2 and 27.26±3.84 kg/m^2, respectively (p=0.081).

Table 1. Sociodemographic and Anthropometric Characteristics

Variables	N=314	%
Sex		
Female	178	56.7
Male	136	43.3
Marital Status		
Married	230	73.2
Single	84	26.8
Living		
Alone	41	13.1
With family	269	85.7
With relative(s)	1	0.3
With friend(s)	3	1.0
Education Level		
Illiterate	1	0.3
Primary school	22	7.0
Middle school	22	7.0
High school	73	23.2
Undergraduate	165	52.5
Graduate	31	9.9
BMI (Mean=26.1 kg/m^2, SD=4.28)		
Underweight (<18.5)	7	2.2
Normal weight (18.5–24.9)	129	41.1
Overweight (25–29.9)	118	37.6
Obese (≥30)	60	17.1
Mediterranean Diet Adherence Screener (Mean=4.61, SD=2.31)		
Low (≤5)	214	68.2
Medium (6-8)	79	25.2
High (≥9)	21	6.7

It was determined that 54.1% of the participants did not have a diagnosed chronic disease. While 6.7% of the participants had cardiovascular diseases, 10.8% had hypertension, 5.4% had diabetes, 2.5% had fatty liver disease or thyroid disorders, 6.1% had gastrointestinal disorders, and 9.2% had respiratory diseases. The rate of participants who did not consume alcohol was 71.7%.

It was found that 29% of the participants were diagnosed with COVID-19 in 2020, 44.9% were diagnosed in 2021, and 26.1% were diagnosed in 2022. While 59.2% of the participants had been vaccinated before their COVID-19 diagnosis, 78.7% received treatment at home. The rate of participants who were intubated for treatment was 0.3%.

Dietary characteristics

Most participants consumed three or four meals (30.9% and 30.6%, respectively) per day. It was stated by 41.1% of the participants that they sometimes skipped meals. The rate of those who had snacks between meals was 51.6%. It was learned that 36.9% of the participants skipped meals, as they did not have time. It was found that 48.1% of the participants ate outside their homes 2 times a week. Most participants (67.8%) had low Mediterranean diet quality levels (Table 1). The mean Mediterranean diet quality scores of the participants were 4.90±2.37 in women and 4.21±2.17 in men (p=0.04).

It was determined that 27.1% of the participants did not take vitamin-mineral supplements regularly. Among those who took vitamin-mineral supplements, 4.8% took iron, 9.1% took vitamin B12, 19.4% took vitamin D, 3.8% took omega-3, and 1.6% took vitamin C supplements.

Brain fog levels

The mean BFS scores of the participants were 34.5±10.7 for cognitive symptoms, 18.8±6.9 for physical symptoms, and 9.7±4.1 for psychological symptoms. The cognitive symptoms subscale scores of the participants varied significantly between women and men (p=0.012). No significant difference was found in the physical symptoms or psychological symptoms subscale scores of the participants based on sex (respectively, p=0.174 and p=0.09).

Table 2. Comparison of MEDAS Scores Based on BFS Subscale Scores, Age, and Anthropometric Measurements

	MEDAS			
	Low (≤5)	**Medium (6-8)**	**High (≥9)**	**p-value**
	Mean±SD	**Mean±SD**	**Mean±SD**	
Age (yr)	39.26±10.61	41.53±10.25	40.38±11.15	0.167
Weight (kg)	74.35±15.42	72.92±14.19	67.98±10.68	0.221
BMI (kg/m^2)	26.25±4.44	25.88±3.97	25.40±3.80	0.727
Cognitive Symptoms	34.39±12.46	32.39±11.09	28.67±8.07	0.075
Physical Symptoms	19.58±7.51	17.34±6.43	16.67±4.67	**0.022***
Psychological Symptoms	10.02±4.16	9.20±3.64	9.05±4.53	0.145

*p<0.05. BMI Body Mass Index, Kruskal-Wallis Test.

The MEDAS scores of the participants did not differ significantly according to their BMI values. While the mean MEDAS scores of the participants differed significantly based on their BFS physical symptoms subscale scores (p=0.022), their MEDAS scores did not significantly differ based on their cognitive symptoms or psychological symptoms subscale scores (Table 2).

Table 3. Comparison of BFS subscale scores based on COVID-19 diagnosis- and treatment-related characteristics

	Cognitive Symptoms	Physical Symptoms	Psychological Symptoms
Vaccinated			
Yes	33.09±11.73	19.11±6.87	10.02±4.16
No	34.12±12.29	18.41±7.04	9.36±3.91
p-value	0.41	0.34	0.17
Symptom duration			
Less than 1 week	31.76±10.32	18.29±6.7	9.90±4.18
1-2 weeks	33.50±12.02	18.69±6.74	9.58±3.91
3-4 weeks	35.33±11.20	19.90±7.05	9.17±2.85
More than 1 month	43.85±19.33	22.54±9.51	12.00±6.53
p-value	0.081	0.35	0.65
Treatment			
At home	33.11±11.65	18.76±6.90	9.72±4.11
Outpatient + at home / in hospital (inpatient)	35.00±13.68	19.53±7.90	10.47±4.05
Intensive care	34.14±11.86	18.04±5.66	8.71±3.24
p-value	0.39	0.45	0.12
Treatment duration			
Less than 1 week	35.6±13.30	21.00±7.18	10.58±5.01
1-2 weeks	36.31±14.63	19.47±7.01	9.22±3.29
3-4 weeks	57.33±24.21	27.00±11.53	16.00±7.81
More than 1 month	48.00±11.31	23.00±11.31	14.50±4.95
p-value	0.16	0.57	0.12
Used medication			
Yes	34.48±12.41	19.14±7.11	9.94±4.05
No	31.51±10.75	18.18±6.56	9.36±4.09
p-value	0.05	0.37	0.14
Intubated			
Yes	27±0.0	11±0.0	9±0.0
No	33.53±11.97	18.85±6.94	9.75±4.07
p-value	0.57	0.17	0.98

The BFS subscale scores of the participants did not vary based on their COVID-19-related characteristics, including vaccination status, symptom duration, treatment duration, treatment place, medication use status, and intubation status (Table 3). There was also no significant difference between the BFS subscale scores of the participants based on how long ago they recovered from COVID-19. There was a positive but statistically insignificant correlation between the MEDAS scores of the participants and how long ago they recovered from COVID-19 (r=0.062, p=0.276).

Table 4. Correlations Between Scale Scores

No	Variables	1	2	3	4	5
1	Cognitive symptoms	1				
2	Physical symptoms	**0.639****	1			
3	Psychological symptoms	**0.653****	**0.640****	1		
4	MEDAS	-0.091	**-0.169****	-0.092	1	
5	BMI	-0.089	-0.040	-0.061	-0.015	1

Spearman's rho, ** Correlation is significant at the 0.01 level (2-tailed)

As seen in Table 4, there was a negative relationship between the BMI values and total MEDAS scores of the participants, but this relationship was not statistically significant (p>0.05). On the other hand, the MEDAS scores and BFS physical symptoms subscale scores of the participants were negatively and significantly correlated (r=-0.169, p<0.01). The BFS cognitive symptoms and

psychological symptoms subscale scores of the participants were negatively related to their MEDAS scores, but these relationships were not statistically significant ($p>0.05$).

DISCUSSION

The number of studies on the development of cognitive problems in individuals recovering from COVID-19 is constantly increasing. WHO highlighted those individuals who have had COVID-19 infection may experience problems in attention, memory, and clear thinking (WHO,2020). It is stated that brain fog is a "chronic immune activation" in individuals who experience and survive COVID-19. It was also pointed out that the brain fog symptoms of these individuals are a form of posttraumatic stress disorder (PTSD) (Bautista-Rodriguez et al.,2023). Brain fog is one of the most frequently encountered symptoms of long COVID (Orfei et al., 2022). This cross-sectional study, which was conducted in this context, aimed to identify the brain fog levels in individuals who recovered from COVID-19, the relationship between these levels and Mediterranean Diet Quality Index scores, and the adherence of these individuals to the Mediterranean diet. The risk factors of long COVID include advanced age, high BMI, and female sex (Klimkiewicz et al.,2022). With a mean BMI of 26.1 ± 4.28 kg/m² and a mean age of 40.08 ± 10.56 years, the participants in our study faced risks in terms of these parameters. Similarly, the BFS cognitive symptoms subscale scores of the male and female participants differed significantly from each other ($p=0.012$). The BFS subscale scores of the participants were 34.5±10.7 for cognitive symptoms, 18.8±6.9 for physical symptoms, and 9.7±4.1 for psychological symptoms. In a study carried out with 120 patients hospitalized due to COVID-19, it was determined that even months later, 34% suffered from memory loss, and 27% suffered from concentration problems (Garrigues et al.,2020). In the study conducted by Liu et al., in comparison to the control group, COVID-19 survivors had a 2.72 times higher incidence of mild cognitive impairment and a 3.09 times higher incidence of dementia.

Long COVID syndrome consists of multiple persistent symptoms that can last a few weeks or months after recovering from COVID-19. It is estimated that it affects at least one-third of patients, and its incidence increases in those who are hospitalized due to COVID-19 (Orfei et al., 2022). In our study, the BFS subscale scores of the participants did not significantly differ depending on their COVID-19 vaccination or intubation statuses. There was also no significant relationship between the BFS subscale scores of the participants depending on how long ago they recovered from COVID-19 (Table 3). It is believed that the results of this study may have been different because most participants (78.7%) had been treated at home and were not hospitalized.

There is still not much information about the dietary approaches that need to be adopted before (prevention), during, and after COVID-19 infection in the short and long term. Nevertheless, as the Mediterranean diet is considered one of the healthiest nutritional models in general, it may also be considered a potentially applicable option (Angelidi et al.,2021). In our study, 68.2% of the participants were found to have low levels of adherence to the Mediterranean diet, whereas only 6.7% had high levels of adherence. Similarly, in a study conducted with 900 healthy adults, a significantly lower MedDietScore was observed in those who were infected with SARS-CoV-2, and was associated with lower consumption rates of fruits, vegetables, and olive oil (Ponzo et al.,2021). High levels of adherence to the Mediterranean diet lower the risk of long COVID symptoms (Pavlidou et al.,2024). In an online study like ours that included 3797 participants, it was seen that adherence to the Mediterranean diet reduced the risk of anxiety development. In contrast, the worsening of diet quality during the pandemic raised the risk of anxiety development (Boaz et al.,2021). In our study, a significant negative relationship was identified between the MEDAS scores and the BFS physical symptoms subscale scores of the participants. Accordingly, as adherence to the Mediterranean diet decreased among the participants, their physical brain fog symptoms increased ($r=-0.169$, $p<0.01$).

Study Limitations

Collecting data via telephone interviews may lead to communication limitations compared to face-to-face interviews. Due to the cross-sectional design of the study, causal relationships cannot be established; only associations between variables can be assessed. Additionally, since the study was conducted in a single hospital, the findings have limited generalizability to other regions or socioeconomic groups. The exclusion of individuals who do not speak Turkish, to ensure more effective communication, also reduces the diversity of the sample.

CONCLUSION

The COVID-19 pandemic has affected several countries worldwide, and it remains a serious public health problem due to its post-acute sequelae. Brain fog, which is one of the most frequently encountered symptoms of post-acute sequelae, substantially influences activities of daily living and lowers the quality of life of those affected.

Our results also showed that the adherence of individuals who recovered from COVID-19 to the Mediterranean diet was low in general, and as their adherence to the Mediterranean diet decreased, they were more likely to show physical brain fog symptoms. To prevent the development of brain fog and improve its prognosis, adherence to the Mediterranean diet should be promoted. The Mediterranean diet is a sustainable nutritional model that has beneficial effects on the preservation of the brain and cognitive functions of individuals. Recommending the Mediterranean diet to individuals experiencing brain fog and offering them diet-related education will be an important step in the prevention of cognitive impairments. Awareness should be raised in society regarding the adoption of this diet.

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Conflict of Interest

No potential conflict of interest was reported by the author(s).

Author Contributions

Plan, design: ZO, BB; **Material, methods, and data collection:** BB; **Data analysis and comments:** BB, CYM; **Writing and corrections:** ZO, BB, CYM.

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REFERENCES

Angelidi, A. M., Kokkinos, A., Katechaki, E., Ros, E., & Mantzoros, C. S. (2020). Mediterranean diet as a nutritional approach for COVID-19. Metabolism, 114, 154407. https://doi.org/10.1016/j.metabol.2020.154407

Atik, D., & Manav, A. İ. (2023). A scale development study: Brain fog scale. Psychiatria Danubina, 35(1), 73–79. https://doi.org/10.24869/psyd.2023.73

Barrea, L., Grant, W. B., Frias-Toral, E., Vetrani, C., Verde, L., de Alteriis, G., et al. (2022). Dietary recommendations for post-COVID-19 syndrome. Nutrients, 14(6), 1305. https://doi.org/10.3390/nu14061305

Bautista-Rodriguez, E., Cortés-Álvarez, N. Y., Vuelvas-Olmos, C. R., Reyes-Meza, V., González-López, T., Flores-de-los-Ángeles, C., et al. (2023). Stress, anxiety, depression and long COVID symptoms. Fatigue: Biomedicine, Health & Behavior, 11(1), 35–54. https://doi.org/10.1080/21641846.2022.2154500

Boaz, M., Navarro, D. A., Raz, O., & Kaufman-Shriqui, V. (2021). Dietary changes and anxiety during the coronavirus pandemic: Differences between the sexes. Nutrients, 13(12). https://doi.org/10.3390/nu13124193

Carey, C., O'Sullivan, M., O'Mahony, M., Sheahan, A., & Barrett, P. (2024). Two years of COVID-19 outbreaks in residential care facilities: Quantifying workload impact of outbreak control activities on a regional public health team in Ireland, March 2020 to March 2022. Irish Journal of Medical Science, 193(2), 543–548. https://doi.org/10.1007/s11845-023-03486-4

Chasco, E. E., Dukes, K., Jones, D. S., Comellas, A. P., Hoffman, R. M., & Garg, A. (2022). Brain fog and fatigue following COVID-19 infection: An exploratory study of patient experiences of long COVID. International Journal of Environmental Research and Public Health, 19(23). https://doi.org/10.3390/ijerph192315499

Dietz, T. K., & Brondstater, K. N. (2024). Long COVID management: A mini review of current recommendations and underutilized modalities. Frontiers in Medicine, 11, 1430444. https://doi.org/10.3389/fmed.2024.1430444

Garrigues, E., Janvier, P., Kherabi, Y., Le Bot, A., Hamon, A., Gouze, H., et al. (2020). Post-discharge persistent symptoms and health-related quality of life after hospitalization for COVID-19. Journal of Infection, 81(6), e4–e6. https://doi.org/10.1016/j.jinf.2020.08.029

Ishikura, T., Nakano, T., Kitano, T., Tokuda, T., Sumi-Akamaru, H., & Naka, T. (2023). Serum ferritin level during hospitalization is associated with brain fog after COVID-19. Scientific Reports, 13(1). https://doi.org/10.1038/s41598-023-40011-0

Klimkiewicz, J., Pankowski, D., Wytrychiewicz-Pankowska, K., Klimkiewicz, A., Siwik, P., Klimczuk, J., et al. (2022). Analysis of the relationship among cognitive impairment, nutritional indexes and the clinical course among COVID-19 patients discharged from hospital—Preliminary report. Nutrients, 14(8). https://doi.org/10.3390/nu14081580

Liu, Y., Wang, H., & Hughes, M. C. (2023). Health behaviors, financial difficulties, and depressive symptoms among older adults across gender and race during the COVID-19 pandemic. Gerontology and Geriatric Medicine, 9, 1–10. https://doi.org/10.1177/23337214231192820

Martinez-Gonzalez, M. A., Garcia-Arellano, A., Toledo, E., Salas-Salvadó, J., Buil-Cosiales, P., Corella, D., et al. (2012). A 14-item Mediterranean diet assessment tool and its association with cardiovascular risk factors: The PREDIMED study. Nutrition, Metabolism and Cardiovascular Diseases, 22(4), 293–299. https://doi.org/10.1016/j.numecd.2011.09.001

Mazza, E., Ferro, Y., Pujia, R., Mare, R., Maurotti, S., Montalcini, T., et al. (2021). Mediterranean diet in healthy aging. Journal of Nutrition, Health & Aging, 25(9), 1076–1083. https://doi.org/10.1007/s12603-021-1675-6

Melzer, T. M., Manosso, L. M., Yau, S. Y., Gil-Mohapel, J., & Brocardo, P. S. (2021). In pursuit of healthy aging: Effects of nutrition on brain function. International Journal of Molecular Sciences, 22(9), 5026. https://doi.org/10.3390/ijms22095026

Onder, A. H., & Seremet-Kurklu, N. (2023). The effect of adherence to Mediterranean diet on inflammation and recurrence in cancer patients. Osmangazi Journal of Medicine, 45(4), 504–513. https://doi.org/10.20515/otd.1283977

Orfei, M. D., Porcari, D. E., D'Arcangelo, S., Maggi, F., Russignaga, D., & Ricciardi, E. A. (2022). New look on long-COVID effects: The functional brain fog syndrome. Journal of Clinical Medicine, 11(19). https://doi.org/10.3390/jcm11195529

Pavlidou, E., Papadopoulou, S. K., Antasouras, G., Spanoudaki, M., Mentzelou, M., Dimoliani, S., et al. (2024). Evaluating the sociodemographic, anthropometric and lifestyle parameters, depression, quality of life, cognitive status, physical activity, and Mediterranean diet adherence of older adults in pre- and post-COVID-19 periods: A comparative cross-sectional study. Psychology & Health, 39(13), 2013–2038. https://doi.org/10.1080/08870446.2024.2352053

Pehlivanoglu, E. F. O., Balcıoglu, H., & Unluoglu, I. (2020). Adaptation of the Mediterranean Diet Adherence Scale into Turkish: Validity and reliability study. Osmangazi Medical Journal, 42(2), 160–164.

Ponzo, V., Pellegrini, M., D'Eusebio, C., Bioletto, F., Goitre, I., Buscemi, S., et al. (2021). Mediterranean diet and SARS-CoV-2 infection: Is there any association? A proof-of-concept study. Nutrients, 13(5). https://doi.org/10.3390/nu13051721

Serra-Majem, L., Tomaino, L., Dernini, S., Berry, E. M., Lairon, D., Ngo de La Cruz, J., et al. (2020). Updating the Mediterranean pyramid towards sustainability: Focus on environmental concerns. International Journal of Environmental Research and Public Health, 17(23), 1–20. https://doi.org/10.3390/ijerph17238758

Tuttolomondo, A., Simonetta, I., Daidone, M., Mogavero, A., Ortello, A., & Pinto, A. (2019). Metabolic and vascular effect of the Mediterranean diet. International Journal of Molecular Sciences, 20(19), 4716. https://doi.org/10.3390/ijms20194716

World Health Organization. (2010). Obesity: Preventing and managing the global epidemic (WHO Technical Report Series, No. 894). World Health Organization. https://apps.who.int/iris/handle/10665/42330

World Health Organization. (2015). Healthy diet (Fact sheet). https://www.who.int/news-room/fact-sheets/detail/healthy-diet

World Health Organization. (2020). Support for rehabilitation self-management after COVID-19-related illness. https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/publications