İKÇÜ SBFD

2026 • CİLT 11 • SAYI 2 • 267-273
DOI: 10.61399/ikcusbfd.1752561

RESEARCH / ARAŞTIRMA

COVID-19 Anxiety and Health-Related Factors Associated with Gluten-Free Diet Adherence in Celiac Disease Patients

Gülşah KANER [1], Çağla AYER [2], İrem MERAL [3], Selcan DUVAR GİRGİN [4]

[1] Department of Nutrition and Dietetics, Faculty of Health Sciences, Izmir Katip Celebi University, Izmir, Türkiye. **ORCID:** 0000-0001-5882-6049
[2] Department of Nutrition and Dietetics, Faculty of Health Sciences, Izmir Katip Celebi University, Izmir, Türkiye. **ORCID:** 0000-0001-6124-7339
[3] Department of Nutrition and Dietetics, Faculty of Health Sciences, Izmir Katip Celebi University, Izmir, Türkiye. **ORCID:** 0000-0002-7741-2324
[4] Department of Nutrition and Dietetics, Faculty of Health Sciences, Izmir Katip Celebi University, Izmir, Türkiye. **ORCID:** 0009-0008-0564-141X

ABSTRACT

Objective: Celiac disease (CD) is a chronic autoimmune disorder requiring lifelong adherence to a gluten-free diet (GFD). The COVID-19 pandemic has significantly impacted the lifestyle, psychological well-being, and dietary management of individuals with chronic illnesses, including CD. This study aimed to examine the relationship between COVID-19-related anxiety and adherence to a GFD among adults with CD, and to evaluate changes in dietary behaviors, access to gluten-free products, and professional dietary support during the pandemic.
Material and Methods: A cross-sectional study was conducted among adults with physician-diagnosed celiac disease in Türkiye. Participants completed an online questionnaire assessing demographic characteristics, CD-related symptoms, comorbidities, GFD adherence, dietitian consultation, and COVID-19-related anxiety.
Results: A significant association was found between COVID-19-related anxiety and greater adherence to a GFD (p=0.020), as well as with specific symptoms such as diarrhea (p=0.032), and comorbidities like thyroid disease (p=0.034) and bone-joint disease (p=0.019). Despite 54% of participants never having received dietitian counseling, and only 15% continuing dietary support during the pandemic, 56.5% reported GFD adherence. Major barriers included product inaccessibility and cost. Although probiotic/supplement use increased slightly, no significant changes in meal frequency, preparation habits, or physical activity were observed.
Conclusion: COVID-19-related anxiety appears to have motivated stronger dietary adherence among individuals with celiac disease. However, limited access to professional support and gluten-free foods highlights the need for improved healthcare access and dietary resources during public health crises.
Keywords: Celiac disease, COVID-19 anxiety, gluten-free diet.

Çölyak Hastalığında Glutensiz Diyete Bağlılıkla İlişkili COVID-19 Anksiyetesi ve Sağlıkla İlgili Faktörler

ÖZET

Amaç: Çölyak hastalığı (ÇH), glutensiz diyete (GD) ömür boyu bağlılık gerektiren kronik bir otoimmün hastalıktır. COVID-19 salgını, ÇH dahil kronik hastalıkları olan bireylerin yaşam tarzını, psikolojik refahını ve diyet yönetimini önemli ölçüde etkilemiştir. Bu çalışmanın amacı, ÇH'li yetişkinler arasında COVID-19 ile ilişkili anksiyete ve GD'ye bağlılık arasındaki ilişkiyi incelemek ve pandemi sırasında diyet davranışlarındaki değişiklikleri, glutensiz ürünlere erişimi ve profesyonel diyet desteğini değerlendirmektir.
Gereç ve Yöntem: Türkiye'de doktor tanılı çölyak hastalığı olan yetişkinler arasında kesitsel bir çalışma gerçekleştirilmiştir. Katılımcılar demografik özellikleri, ÇH ile ilişkili semptomları, komorbiditeleri, GFD bağlılığını, diyetisyen konsültasyonunu ve COVID-19 ile ilişkili anksiyeteyi değerlendiren çevrimiçi bir anket formu uygulanmıştır.
Bulgular: COVID-19 ile ilişkili anksiyete ile GD'ye daha fazla bağlılık (p=0,020) arasında ve ayrıca diyare (p=0,032) gibi spesifik semptomlar ve tiroid hastalığı (p=0,034) ve kemik-eklem hastalığı (p=0,019) gibi komorbiditeler arasında anlamlı bir ilişki bulunmuştur. Katılımcıların %54'ünün hiç diyetisyen danışmanlığı almamış olmasına ve yalnızca %15'inin pandemi sırasında diyet desteğine devam etmesine rağmen, %56,5'i GD'ye uyduğunu bildirmiştir. Başlıca engeller arasında ürünlere erişilememesi ve maliyet yer almaktadır. Probiyotik/takviye kullanımı hafifçe artmış olsa da öğün sıklığı, hazırlama alışkanlıkları veya fiziksel aktivitede önemli bir değişiklik gözlenmemiştir.
Sonuç: COVID-19 ile ilgili kaygı, çölyak hastalığı olan bireyler arasında diyete daha güçlü bağlılığı motive etmiş gibi görünmektedir. Bununla birlikte, profesyonel desteğe ve glutensiz besinlere sınırlı erişim, halk sağlığı krizleri sırasında sağlık hizmetlerine erişimin ve diyet kaynaklarının iyileştirilmesi ihtiyacını vurgulamaktadır.
Anahtar Kelimeler: Çölyak hastalığı, COVID-19 anksiyetesi, glutensiz diyet.

Geliş Tarihi/Received: 29.07.2025 , Kabul Tarihi/Accepted: 16.09.2025

Corresponding Author
İrem Meral, Department of Nutrition and Dietetics, Faculty of Health Sciences, Izmir Katip Celebi University, Izmir, Türkiye.
E- mail: dytiremhelvacioglu@gmail.com **ORCID:** 0000-0002-7741-2324
The article has not been presented at any scientific event.

1. Introduction

Coronavirus disease-2019 (COVID-19) was first identified in Wuhan city of Hubei Province China and was declared as a pandemic by the World Health Organization (WHO) (1). COVID-19 affects multiple systems, including respiratory, cardiovascular, endocrine, autoimmune, and gastrointestinal systems (2).

Celiac disease is an immune system-mediated gluten-sensitive enteropathy that occurs as a result of the consumption of gluten-containing foods such as barley, rye and wheat in individuals with a genetic predisposition (3). The worldwide prevalence rate ranges between 1-2% and this rate varies across countries (4). Individuals with autoimmune and gastrointestinal disorders such as celiac disease may be more vulnerable to COVID-19 (5). There are conflicting findings in the literature on this subject. While some studies suggest that individuals with celiac disease are more adversely affected by COVID-19 than healthy individuals (6,7), other studies indicate that COVID-19 doesn't a significant impact on individuals with celiac disease (8).

The only treatment for celiac disease is a lifelong gluten-free diet (GFD) (9). The literature shows that a regular food supply and favorable social conditions are key to maintaining this diet (10). Individuals' lifestyles, health status and eating habits have been affected by the COVID-19 pandemic (11). Problems such as quarantine measures, social isolation and restrictions in the food supply have caused psychological and physical difficulties especially for individuals with special nutritional needs such as celiac disease (12, 13). In addition, studies of individuals with celiac disease have shown that the perception of the risk of developing COVID-19 varies. A study of 10,737 individuals with celiac disease in ten countries revealed an increased perceived risk of developing COVID-19 compared with the general population (14). In contrast to the findings of this study, a similar investigation conducted in Italy reported that 56.6% of individuals with celiac disease did not consider themselves vulnerable, and 48.5% expressed no concerns about potential restrictions on access to gluten-free foods (15).

While several international studies have investigated the relationship between COVID-19-related anxiety and adherence to a gluten-free diet in individuals with celiac disease, such evidence remains scarce within the national context. In particular, there is limited data from our country regarding how the perceived anxiety of patients with CD during the pandemic may have shaped their eating behaviors and gluten-free diet adherence (16, 17). To address this gap, the present study aims to bridge the knowledge derived from global findings with national data, thereby contributing novel insights into the specific experiences of celiac patients in our country.

2. Materials and Methods

2.1. Study Design and Participants

The data used in this cross-sectional study were collected between September 2021 and April 2022 via the snowball sampling method. The study population consisted of adults with celiac disease residing in Türkiye. In a similar study on celiac disease (18), a power analysis based on the pandemic effect revealed that 133 subjects were optimal with an effect size of 0.2143, 80% power and 5% type 1 error. The participants who volunteered for the study signed the consent form and completed the questionnaire. This study was conducted in accordance with the principles of the Declaration of Helsinki.

Participants were included if they had a physician-diagnosed celiac disease, were aged from 18 years to 65 years, and voluntarily agreed to participate. Individuals with non-celiac gluten sensitivity and/or wheat allergy, or those younger than 18 years or older than 65 years, were excluded.

2.2. Data Collection

This study used an online questionnaire (via Google Forms) to examine how the dietary habits and GFD practices of adults with celiac disease changed during the COVID-19 pandemic. The participants were first informed about the study, gave their consent, and then completed the questionnaire. The form was shared through social media platforms such as Facebook, Instagram, WhatsApp, and Telegram. The contact details of the responsible researcher were included, and participants could reach out with any questions or problems. Before data collection, a pilot test was conducted with 10 people. On the basis of their feedback, necessary adjustments were made, and the final questionnaire was launched.

The questionnaire had three main parts, including structured questions (with predefined response categories) and open-ended items that allowed participants to provide additional details. The first part asked about general information such as age, gender, marital status, education level, weight (kg), and height (cm). Body Mass Index (BMI, kg/m^2) was calculated via self-reported weight and height, and classified as underweight, normal, overweight, or obese according to WHO standards. The second part included questions about celiac disease, such as how long ago the diagnosis was made, symptoms, and whether the person had any other chronic disease. The third part focused on GFD practices, including whether participants had received dietitian support and any difficulties they faced following the diet. In the last section, the participants were asked about changes in their eating habits and physical activity compared to previous habits before the COVID-19 pandemic.

2.3. Statistical Analysis

The data were analyzed via SPSS 25.0 (IBM, USA). The normal distribution of the data was evaluated by examining the kurtosis and skewness values. Descriptive statistics were presented as the means and standard deviations, and categorical variables were presented as numbers (n) and percentages (%). The Pearson chi-square test was used for discrete variables in intergroup comparisons. One way ANOVA test was used to compare the means of three or more independent groups with a parametric distribution. The marginal homogeneity test was used to compare the differences before and during the COVID-19 pandemic. In the analyses, if the p value was less than 0.05, it was considered statistically significant.

2.4. Ethical Aspects of the Research

Prior to the study, permission was obtained from the Scientific Research Platform of the Ministry of Health of the Republic of Türkiye on July 27, 2021. Additionally, ethical approval was granted by the Izmir Katip Celebi University Non-Interventional Clinical Research Ethics Committee on August 24, 2021 (Approval No:1054).

3. Results

The study included 154 individuals with celiac disease, with a mean age of 37.90 ± 10.70 years. Among the participants, 72.7% were female and 68.2% were married. More than half (52.6%)

held a bachelor's degree or higher, and 61.0% were currently employed. On the basis of self-reported data, the BMI (kg/m^2) classification was as follows: 54.5% of participants were in the normal weight range, 26.6% were overweight, and 11.7% were underweight. When asked about their anxiety regarding contracting COVID-19 within the past two weeks, 34.4% responded "never," 33.1% responded "frequently," and 32.5% responded "rarely." There was no statistically significant difference in general knowledge levels among participants according to their levels of COVID-19-related anxiety (Table 1).

With respect to disease history, 61.0% had been diagnosed with celiac disease for ≤6 years. The most commonly reported symptoms were abdominal pain and bloating (68.2%), diarrhea (46.1%), constipation (26.6%), and vomiting (18.2%). A significantly greater proportion of participants who reported anxiety about COVID-19 also reported diarrhea (p=0.032; Bonferroni correction p=0.011). Additionally, 44.8% had at least one non-celiac chronic disease, the most common being thyroid disorders (20.1%), neurological diseases (18.8%), bone-joint diseases (13.0%), and diabetes mellitus (9.1%). Statistically significant associations were found between COVID-19 related-anxiety and the presence of thyroid disease (p=0.034; Bonferroni correction p=0.011) and between COVID-19 anxiety and bone-joint disease (p=0.019; Bonferroni correction p=0.006). There was a statistically significant difference between individuals with thyroid disease (occasionally-never) and those with bone and joint disease (frequently- occasionally; occasionally - never) in terms of anxiety related to contracting COVID-19 (p=0.034, p=0.019, respectively). 51.9% of the participants did not use any medication (Table 2).

More than half of the participants (56.5%) reported that adhering to a GFD those with COVID-19 anxiety who adhered to a GFD were significantly more likely to follow this diet (p=0.020; Bonferroni correction p=0.006). Among those who adhered to the diet (n=87), 46.0% had received prior dietitian counseling, although only 15.0% continued with ongoing support. Most participants (87.4%) reported difficulties in maintaining their diet, primarily due to limited product availability (65.8%) and high costs (39.5%). Despite being diagnosed, 14.9% had consumed gluten (Table 3).

Compared with the pre-pandemic period, there was an increase in the use of probiotics and dietary supplements (from 32.5% to 35.1%), although the change was not statistically significant. Conversely, a slight decline was observed in physical activity (from 32.5% to 26.0%), gluten-free bread preparation (from 66.9% to 65.6%), and home-cooked gluten-free meals (from 70.8% to 70.1%), none of which reached statistical significance (p>0.05). Moreover, more than half of the participants reported no change in meal frequency (58.5%), meal skipping (64.2%), timing of meals (64.2%), or water intake (64.8%) during the pandemic (Table 4) (Figure 1).

Table 1. Participants' characteristics and COVID-19 anxiety

				Anxiety						
				Frequently		Occasionally		Never		
Variables		**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**p**
Age (years)	18-39	82	53.2	27	52.9	28	56.0	27	50.9	χ^2=0.267 p=0.875
	40-65	72	46.8	24	47.1	22	44.0	26	49.1	
	Mean ± SD	37.90±10.70		39.04±10.17		36.02±9.87		38.58±11.85		F=1.173 p=0.312
Gender	Male	42	27.3	10	19.6	16	32.0	16	30.2	χ^2=2.301 p=0.316
	Female	112	72.7	41	80.4	34	68.0	37	69.8	
Marital Status	Married	105	68.2	38	74.5	30	60.0	37	69.8	χ^2=2.549 p=0.280
	Single	49	31.8	13	25.5	20	40.0	16	30.2	
Education Level	<Bachelor's	73	47.4	26	51.0	21	42.0	26	49.1	χ^2=0.905 p=0.636
	≥Bachelor's	81	52.6	25	49.0	29	58.0	27	50.9	
Employment Status	Employed	94	61.0	35	68.6	28	56.0	31	58.5	χ^2=1.914 p=0.384
	Not employed	60	39.0	16	31.4	22	44.0	22	41.5	
BMI (kg/m^2)	Underweight	18	11.7	4	7.8	9	18.0	5	9.4	χ^2=3.468 p=0.748
	Normal weight	84	54.5	31	60.8	24	48.0	29	54.7	
	Overweight	41	26.6	13	25.5	13	26.0	15	28.3	
	Obese	11	7.1	3	5.9	4	8.0	4	7.5	
Total		154	100.0	51	33.1	50	32.5	53	34.4	-

Chi-square test, One Way ANOVA, *p<0.05

4. Discussion

This study highlights several important findings regarding the experiences of adults with celiac disease during the pandemic. Notably, individuals who reported anxiety about contracting COVID-19 were more likely to adhere to a GFD. This may reflect heightened health awareness and risk avoidance behaviors triggered by the pandemic. Furthermore, a significant association was found between COVID-19 anxiety and the presence of specific gastrointestinal symptoms such as diarrhea, as well as chronic comorbidities such as thyroid and bone-joint diseases, suggesting that underlying health concerns may amplify pandemic-related stress in this population (19). Previous evidence has shown that celiac patients with additional chronic conditions reported greater COVID-19-related concerns than those with celiac disease alone (14, 15). Our results align with this, especially for thyroid and bone-joint diseases, although the

Table 2. Participants' disease status and COVID-19 anxiety

				Anxiety						
				Frequently		Occasionally		Never		
Variables		**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**p**
CD diagnosis duration	≤6 years	94	61.0	29	56.9	36	72.0	29	57.7	χ^2=3.791 p=0.143
	>6 years	60	39.0	22	43.1	14	28.0	24	45.3	
CD-related symptoms	Abdominal pain and bloating	105	68.2	38	74.5	31	62.0	36	67.9	χ^2=1.824 p=0.402
	Diarrhea	71	46.1	29[a]	56.9	25[a,b]	50.0	17[b]	32.1	**χ^2=6.879 p=0.032***
	Constipation	41	26.6	13	25.5	15	30.0	13	24.5	χ^2=0.444 p=0.801
	Vomiting	28	18.2	12	23.5	8	16.0	8	15.1	χ^2=1.480 p=0.477
Non-CD chronic disease	Yes	69	44.8	26	51.0	19	38.0	24	45.3	χ^2=1.728 p=0.422
	No	85	55.2	25	49.0	31	62.0	29	54.7	
Existing non-CD chronic disease	Thyroid	31	20.1	13[a,b]	25.5	4[b]	8.0	14[a]	26.4	**χ^2=6.789 p=0.034***
	Neurologic	29	18.8	13	25.5	11	22.0	5	9.4	χ^2=4.870 p=0.088
	Bone-joint	20	13.0	9[a]	17.6	1[b]	2.0	10[a]	18.9	**χ^2=7.943 p=0.019***
	Diabetes mellitus	14	9.1	3	5.9	5	10.0	6	11.3	χ^2=1.004 p=0.605
Medication use	Yes	74	48.1	28	54.9	23	46.0	23	43.4	χ^2=1.503 p=0.472
	No	80	51.9	23	45.1	27	54.0	30	56.6	

Chi-square test, *p<0.05; CD: Celiac Disease

Table 3. Gluten-free diet experience and COVID-19 anxiety

				Anxiety						
				Frequently		Occasionally		Never		
Variables		**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**p**
Adherence a GFD	Yes	87	56.5	36[a]	70.6	28[a,b]	56.0	23[b]	43.4	**χ^2=7.826 p=0.020***
	No	67	43.5	15[a]	29.4	22[a,b]	44.0	30[b]	56.6	
Dietitian consultation before using a GFD	Yes	40	46.0	18	50.0	16	57.1	6	26.1	χ^2=5.303 p=0.071
	No	47	54.0	18	50.0	12	42.9	17	73.9	
Ongoing of dietitian consultation	Yes	6	15.0	2	33.3	3	50.0	1	16.7	χ^2=0.410 p=0.815
	No	34	85.0	16	47.1	13	38.2	5	14.7	
Difficulties to adherence a GFD	Yes	76	87.4	34	94.4	23	82.1	19	82.6	χ^2=2.796 p=0.247
	No	11	12.6	2	5.6	5	17.9	4	17.4	
Difficulties**	Products access	50	65.8	25	73.5	14	60.9	11	57.9	χ^2=1.678 p=0.432
	High price	30	39.5	12	35.3	10	43.5	8	42.1	χ^2=0.458 p=0.795
Gluten intake after diagnosis	Yes	13	14.9	6	16.7	5	17.9	2	8.7	χ^2=0.978 p=0.613
	No	74	85.1	30	83.3	23	82.1	21	91.3	

Chi-square test, *p<0.05, **Multiple responses accepted. GFD: Gluten-free diet

absence of associations with other conditions may reflect sample size limitations or heterogeneity in comorbidities. These findings underscore the need to consider comorbidity status when evaluating psychological well-being and health behaviors patients with in celiac disease, particularly during public health crises.

"*To date, no studies have investigating the relationship between celiac-related symptoms and anxiety about contracting the COVID-19.*" In the present study, a significant association was found only between diarrhea and the various celiac-related symptoms-and anxiety about COVID-19 infection. This finding may be explained by the increase in stress and anxiety levels during the pandemic period, which could negatively affect quality of life and exacerbate gastrointestinal symptoms (19). Future research with larger and more diverse populations is warranted to clarify the nature of this relationship and to better understand the psychosocial dynamics of celiac patients with multiple health conditions.

The only effective treatment for celiac disease is strict adherence to a GFD (20). A study conducted in Morocco involving 103 individuals with celiac disease reported that strict compliance with a GFD during the pandemic was associated with reduced levels of COVID-19-related anxiety (21). Similarly, a multinational study including 10 countries and 10,737 celiac patients revealed

that those adhering to a GFD reported lower levels of anxiety related to COVID-19 (14). In contrast to these findings, the present study revealed that increasing levels of COVID-19-related anxiety were associated with greater adherence to a GFD. Furthermore, 56.5% of the celiac patients in our study reported adhering to a GFD. This may be explained by the increased vulnerability of celiac patients to COVID-19, as well as concerns about the inability to manage potential disease-related symptoms during the pandemic due to restricted access to healthcare services (15, 19). From the perspective of the Health Belief Model, higher levels of anxiety may have strengthened patients' perceived susceptibility to COVID-19 and the perceived severity of its consequences. These beliefs, in turn, may have reinforced the perceived benefits of strict dietary adherence and motivated individuals to comply more rigorously with the GFD despite potential barriers (22).

Table 4. Dietary and physical activity behaviors before vs. during COVID-19

Variables		Before COVID-19		During COVID-19		
		n	%	n	%	Test Value
Probiotic & dietary supplement use	Yes	50	32.5	54	35.1	MH=-0.617 p=0.537
	No	104	67.5	100	64.9	
Physical activity	Yes	50	32.5	40	26.0	MH=1.768 p=0.077
	No	104	67.5	114	74.0	
Gluten-free bread	Home preparation	103	66.9	101	65.6	MH=0.535 p=0.593
	Ready-made	51	33.1	53	34.4	
Gluten-free meal/food	Home preparation	109	70.8	108	70.1	MH=0.378 p=0.705
	Ready-made	45	29.2	46	29.9	

Among individuals with celiac disease, routine follow-up procedures commonly include anthropometric measurements, serological tests, assessments of dietary adherence, evaluations of nutritional adequacy, and assessments of the burden of treatment. At this stage, dietitian counseling plays a critical role (23). A study conducted in India involving 585 individuals with celiac disease reported that 37.2% of those referred to a dietitian discontinued counseling after the initial consultation, whereas only 22% continued receiving dietetic support. Additionally, 40% of the participants stated that they had never received any dietitian counseling following their diagnosis (20). Similarly, in a study conducted in the United Kingdom during the COVID-19 pandemic, 34% of 138 individuals with celiac disease reported that they continued dietitian counseling during this period (24). In the present study, 54% of the participants reported having never received dietary counseling. Among those who had previously consulted a dietitian, 34% indicated that they discontinued follow-up during the COVID-19 pandemic. This trend may be attributed to pandemic-related factors such as increased social isolation, altered risk perception, and reduced accessibility to healthcare services.

During the COVID-19 pandemic, the imposition of quarantine measures has led to various challenges in accessing gluten-free foods for individuals with celiac disease (16). A study conducted in India, which included 505 individuals with celiac disease, reported that while 343 participants reported good adherence to a GFD before the pandemic, 52.4% stated that they were unable to maintain adherence during the pandemic due to access difficulties. The most commonly reported barriers included the increased cost of home delivery for gluten-free products (52.4%), the difficulty of long-distance travel (44.9%), and the rising price of gluten-free items (43.1%) (25). Similarly, in a study conducted in Türkiye with 85 individuals with celiac disease, 55.6% of those adhering at the gluten-free diet reported experiencing difficulties related to gluten-free food. Among the participants, 54.8% indicated that accessing gluten-free products in markets was challenging, whereas 38.7% cited transportation difficulties caused by quarantine restrictions (26). Similarly, a high proportion of participants (87.4%) experienced difficulties in maintaining a GFD, primarily due to limited product accessibility

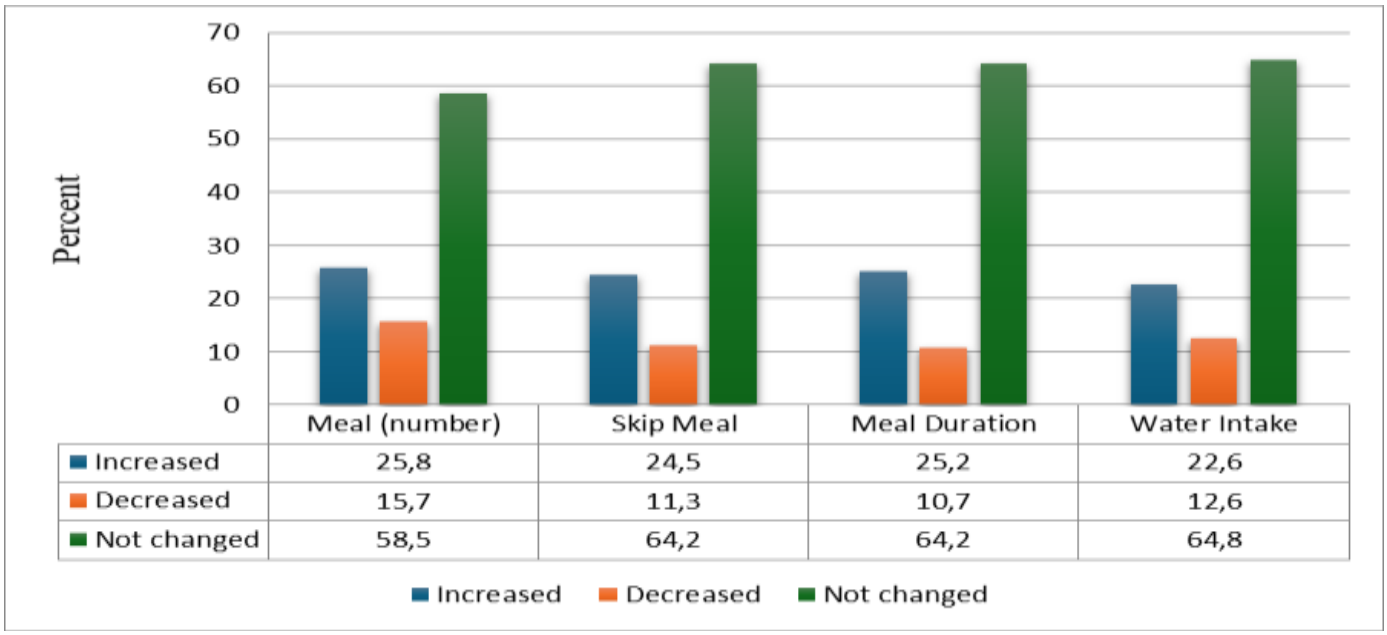


Figure 1. Participants' dietary changes compared to pre-pandemic period

(65.8%) and high costs (39.5%) in the present study. While these findings are consistent with the literature, it is suggested that disruptions in the production, import, and distribution of gluten-free foods during the pandemic may have contributed to these challenges.

Despite the increased use of probiotics and dietary supplements during the pandemic, no significant changes were observed in dietary habits or physical activity levels were observed compared with those in the pre-COVID-19 period. Most participants reported consistent meal patterns, water intake, and home food preparation practices, indicating a degree of resilience in lifestyle behaviors among individuals with celiac disease.

4.1. Limitations

This study has several limitations that should be acknowledged. First, the cross-sectional design limits the ability to establish causal relationships between COVID-19-related anxiety and adherence to a gluten-free diet or other health behaviors. Second, the data were collected through self-reported online surveys, which may be subject to recall bias and social desirability bias, particularly regarding dietary adherence and symptom reporting. In addition, since height and weight data were also self-reported, the possibility of reporting bias in these anthropometric measures should be acknowledged. Third, the sample was recruited via a snowball sampling method, which may have introduced selection bias and limits the generalizability of the findings to the broader population of individuals with celiac disease in Türkiye. Additionally, the sample size, while adequate for statistical analysis, may have limited the power to detect more nuanced associations, particularly regarding specific comorbid conditions. Finally, the study did not include clinical verification of dietary adherence or laboratory markers of disease activity, which strengthens the objectivity of the findings. Future research using longitudinal designs, larger and more diverse samples, and clinically validated measures is needed to better understand the long-term impact of public health crises on dietary management and psychological well-being among individuals with celiac disease.

5. Conclusion and Recommendations

The findings revealed that COVID-19-related anxiety among individuals with celiac disease was associated with increased adherence to the gluten-free diet. Moreover, a substantial proportion of patients had never received dietitian counseling, and among those who had received dietary counseling, only a small proportion (15%) continued follow-up during the pandemic, highlighting a significant drop in sustained professional support. The participants also reported various challenges in adhering to the gluten-free diet. These issues may be attributed to factors such as social isolation, transportation difficulties, disruptions in food production and supply, and heightened risk perception during the pandemic. This study highlights the impact of the COVID-19 pandemic on dietary management and access to healthcare services among individuals with celiac disease, underscoring the need for further research in this area. These findings underscore the need for improved access to gluten-free products and sustained dietary guidance, especially in times of public health crisis. Overall, the results suggest that while some adaptive behaviors emerged during the pandemic, significant barriers to dietary management persist for individuals with celiac disease. From a policy and clinical practice perspective, the findings highlight the urgent need to ensure continuous access to dietitian counseling, particularly through innovative approaches such as telehealth-based nutrition services, to overcome the barriers created by social distancing and healthcare disruptions. Furthermore, the challenges in accessing gluten-free foods emphasize the potential value of state-supported gluten-free food distribution programs or subsidy mechanisms to ensure diet sustainability during crises.

6. Contribution to the Field

The impact of the COVID-19 pandemic on dietary behaviors among individuals with celiac disease has not been sufficiently explored. This investigation represents one of the few empirical assessments of the behavioral impact of pandemic-induced anxiety on dietary adherence among a Turkish cohort with celiac disease. This highlights the need for accessible dietetic support and affordable gluten-free products during crises. These findings contribute to the field of clinical nutrition by highlighting the importance of integrated, patient-centered approaches in managing chronic conditions through diet.

Acknowledgements

The authors are grateful to all individuals who participated in this study.

Conflict of Interest

The authors have no conflicts of interest.

Author Contribution

Study conception and design: GK, SD; Data collection: SD; Data analysis and interpretation: ÇA; Drafting of the article: GK; İM; Critical revision of the article: GK, ÇA, İM.

Funding

This study was supported by The Scientific and Technological Research Council of Turkey (TUBITAK) 2209-A Projects Funding Program

References

1. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. Lancet. 2020 Feb 15;395(10223):470-473. DOI: 10.1016/S0140-6736(20)30185-9.
2. Liu Y, Gu X, Li H, Zhang H, Xu J. Mechanisms of long COVID: An updated review. Chin Med J Pulm Crit Care Med. 2023 Dec 6;1(4):231-240. DOI: 10.1016/j.pccm.2023.10.003.
3. Abadie V, Sollid LM, Barreiro LB, Jabri B. Integration of genetic and immunological insights into a model of celiac disease pathogenesis. Annu Rev Immunol. 2011;29:493-525. DOI: 10.1146/annurev-immunol-040210-092915.
4. Gatti S, Rubio-Tapia A, Makharia G, Catassi C. Patient and community health global burden in a world with more celiac disease. Gastroenterology. 2024 Jun;167(1):23-33. DOI: 10.1053/j.gastro.2024.01.035.
5. Santacroce G, Lenti MV, Aronico N, Miceli E, Lovati E, Lucotti PC, et al. Impact of COVID-19 in immunosuppressive drug-naïve autoimmune disorders: Autoimmune gastritis, celiac disease, type 1 diabetes, and autoimmune thyroid disease. Pediatr Allergy Immunol. 2022 Jan;33 Suppl 27(Suppl 27):105-107. DOIi: 10.1111/pai.13646.
6. Gasbarrini G, Dionisi T, Corazza GR, Aronico N, Cammarota G, Ianiro G, et al. COVID-19 in celiac disease: a multicentric retrospective

cohort study. Eur Rev Med Pharmacol Sci. 2021 Jun;25(12):4400-4404. DOI: 10.26355/eurrev_202106_26150.

7. Zhen J, Stefanolo JP, Temprano MP, Tedesco S, Seiler C, Caminero AF, et al. The risk of contracting COVID-19 is not increased in patients with celiac disease. Clin Gastroenterol Hepatol. 2021 Feb;19(2):391-393. DOI: 10.1016/j.cgh.2020.10.009.

8. Zou Y, Pan M, Zhou T, Yan L, Chen Y, Yun J, et al. Critical COVID-19, Victivallaceae abundance, and celiac disease: A mediation mendelian randomization study. PLoS One. 2024 May 3;19(5):e0301998. DOI: 10.1371/journal.pone.0301998.

9. Elli L, Leffler D, Cellier C, Lebwohl B, Ciacci C, Schumann M, et al. Guidelines for best practices in monitoring established coeliac disease in adult patients. Nat Rev Gastroenterol Hepatol. 2024 Mar;21(3):198-215. DOI: 10.1038/s41575-023-00872-2.

10. Samasca G, Lerner A, Girbovan A, Sur G, Lupan I, Makovicky P, et al. Challenges in gluten-free diet in coeliac disease: Prague consensus. Eur J Clin Invest. 2017 May;47(5):394-397. DOI: 10.1111/eci.12755.

11. Velavan TP, Meyer CG. The COVID-19 epidemic. Trop Med Int Health. 2020 Mar;25(3):278-280. DOI: 10.1111/tmi.13383.

12. Lamy E, Viegas C, Rocha A, Raquel Lucas M, Tavares S, Capela E Silva F, et al. Changes in food behavior during the first lockdown of COVID-19 pandemic: A multi-country study about changes in eating habits, motivations, and food-related behaviors. Food Qual Prefer. 2022 Jul;99:104559. DOI: 10.1016/j.foodqual.2022.104559.

13. Knorr D, Khoo CSH COVID-19 and food: challenges and research needs. Front Nutr. 2020, Dec 3;7:598913 DOI: 10.3389/fnut.2020.598913.

14. Zhen J, Stefanolo JP, Temprano MP, Seiler CL, Caminero A, de-Madaria E, et al. Risk perception and knowledge of COVID-19 in patients with celiac disease. World J Gastroenterol. 2021 Mar 28;27(12):1213-1225. DOI: 10.3748/wjg.v27.i12.1213.

15. Siniscalchi M, Zingone F, Savarino EV, D'Odorico A, Ciacci C. COVID-19 pandemic perception in adults with celiac disease: an impulse to implement the use of telemedicine. Dig Liver Dis. 2020 Oct;52(10):1071-1075. DOI: 10.1016/j.dld.2020.05.014.

16. Gokden Y, Hot S, Adas M, Ogutmen Koc D, Atak S, Hot AB. Celiac disease and COVID-19 pandemic: should we worry? Acta Gastroenterol Belg. 2020 Oct-Dec;83(4):517-525.

17. Uzunkol N. Effects of the COVID-19 pandemic on gluten-free diet compliance and quality of life in celiac patients [master's thesis on the internet]. [Kayseri]: Erciyes University; 2023. [cited 2025 Sep 4]. Available from: https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSonucYeni.jsp

18. Bascuñán KA, Rodríguez JM, Osben C, Fernández A, Sepúlveda C, Araya M. Pandemic effects and gluten-free diet: an adherence and mental health problem. Nutrients. 2021 May 27;13(6):1822. DOI: 10.3390/nu13061822.

19. Möller SP, Apputhurai P, Tye-Din JA, Knowles SR. Quality of life in coeliac disease: relationship between psychosocial processes and quality of life in a sample of 1697 adults living with coeliac disease. J Psychosom Res. 2021 Dec;151:110652. DOI: 10.1016/j.jpsychores.

20. Mehtab W, Agarwal H, Ghosh T, Chauhan A, Ahmed A, Singh A, et al. Patterns of practice in the diagnosis, dietary counselling and follow-up of patients with celiac disease- A patient-based survey. Indian J Gastroenterol. 2023 Feb;42(1):88-95. DOI: 10.1007/s12664-022-01296-7.

21. Boutahar K, Ihbour S, Hadi K, Kaoutar K, Chetoui A, El Kardoudi A, et al. Anxiety and Associated Factors during the COVID-19 Pandemic Confinement in the Moroccan Adult Celiac Disease Population. Port J Public Health. 2023 Jan 16;40(3):163-171. DOI: 10.1159/000528164.

22. Shahnazi H, Ahmadi-Livani M, Pahlavanzadeh B, Rajabi A, Hamrah MS, Charkazi A. Assessing preventive health behaviors from COVID-19: a cross sectional study with health belief model in Golestan Province, Northern of Iran. Infect Dis Poverty. 2020 Nov 17;9(1):157. DOI: 10.1186/s40249-020-00776-2.

23. Husby S, Bai JC. Follow-up of celiac disease. Gastroenterol Clin North Am. 2019 Mar;48(1):127-136. DOI: 10.1016/j.gtc.2018.09.009.

24. Trott N, Raju SA, Rej A, Hoffman O, Holland W, Bebb JR, et al. Long-term follow-up in patients with coeliac disease in the pandemic-era: a view from Sheffield the NHS England national centre for adult coeliac disease. Gastroenterol Hepatol Bed Bench. 2023;16(2):158-166. DOI: 10.22037/ghfbb.v16i2.2637.

25. Mehtab W, Chauhan A, Agarwal A, Singh A, Rajput MS, Mohta S, et al. Impact of Corona Virus Disease 2019 pandemic on adherence to gluten-free diet in Indian patients with celiac disease. Indian J Gastroenterol. 2021 Dec;40(6):613-620. DOI: 10.1007/s12664-021-01213-4.

26. Aydin AI, Baspinar B, Atak M, Demirtas Z, Oztas G, Ozyazicioglu N. Adherence to gluten-free diet and affecting factors in adolescents with celiac disease during the COVID-19. Int J Caring Sci. 2023;16(3):1091.