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RESEARCH ARTICLE

ADHERENCE TO GLUTEN-FREE DIET AND THE SOCIAL RELATED FACTORS IN ADULTS WITH THE CELIAC DISEASE

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ABSTRACT

Purpose: Lifelong dietary adherence is very important in celiac disease. Several factors may affect adherence to a gluten-free diet (GFD). In this study, it was aimed to determine the adherence to a gluten-free diet (GFD) and the factors affecting social life in adults with celiac disease.
Material and Methods: This cross-sectional study was conducted on 98 adults diagnosed with celiac disease, using the telephone interview method of data collection. The level of adherence to GFD was accepted as the dependent variable. Several factors including age, gender, economic status, educational level, and marital status were considered as independent variables. Quantitative variables were compared using the student's t-test, while the Chi-square test was used for qualitative variables. Multiple logistic regression analysis was performed to determine related factors associated with "excellent" adherence to GFD.
Results: 53.1% of the celiac patients reported their adherence to GFD was "excellent", 46.9% was "poor". The celiac patients' 61.2% reported difficulties about to access GFPs and 49.0% of them never consume commercial GFPs. Before eating out, 67.3% of the celiac patients call the restaurant to ask if they have a gluten-free menu. The celiac patients' 69.4% reported that they use a gluten-scanner application. The rate of "excellent" adherence to GFD of the celiac patients who had ≥4 family members were significantly lower (OR: 0.112 CI: 0.15-0.832, p=0.017). The celiac patients with ≥10 diagnosis years had significantly lower adherence to GFD (OR: 0.053 CI: 0.010-0.292, p=0.001). Gluten-scanner applications non-users had 0.163-fold lower "excellent" adherence to GFD (OR: 0.163 CI: 0.034-0.779, p=0.016).
Conclusion: This study emphasizes that having nuclear family, new diagnosis, and use of mobile applications positively affect adherence to GFD.

Keywords: Celiac disease, chronic disease, diet, mobile applications

INTRODUCTION

Celiac disease (CD) is a gastrointestinal system disease that causes deterioration of the villus structures in the intestines and damages the small intestine in individuals with a genetic predisposition (1-4). It has been reported that CD is a rare disease in previous studies, but more recent studies have shown that the prevalence of CD in different populations has increased to 0.3-1% and is gradually increasing all over the world (4, 5). With celiac disease affecting all age ranges in the population, and with a documented higher frequency, there is a growing awareness in society that can be easily seen

Table 1. The celiac patients' socio-demographic, anthropometric, and disease characteristics.

Items	n	%
Gender		
Male	21	21.4
Female	77	78.6
Age groups (years)		
≤30	36	36.7
31-44	38	38.8
≥45	24	24.5
BMI (kg/m^2)		
<18.5	11	11.2
18.5-24.9	51	52.1
25.0-29.9	24	24.5
≥30.0	12	12.2
Working status		
Working	25	25.5
Not working	73	74.5
Education status		
Primary school	21	21.4
Secondary school	10	10.2
High school	44	44.9
College	23	23.5
Marital status		
Married	71	72.4
Not married	27	27.6
Number of family members		
<4	22	22.4
≥4	76	77.6
Economic status		
Bad	13	13.3
Moderate	27	27.5
Good	58	59.2
Diagnosed years		
<10	38	38.8
≥10	60	61.2
Presence of concomitant disease		
Yes	52	53.1
No	46	46.9
Most common concomitant disease*		
Anemia	23	45.1
Osteoporosis	11	21.6
Thyroid diseases	17	33.3
Family members diagnosed with CD		
Yes	18	19.0
No	80	81.0
Self-reported health status		
Good	57	58.2
Not good	41	41.8
Total	**98**	**100.0**

* (n=51), those only who had concomitant disease.

in grocery stores, restaurants, and food manufacturers (5).

Patients diagnosed with CD are advised to consume "gluten-free diet (GFD)" to reduce the severity of gluten-induced acute gastrointestinal symptoms and reduce the risk of chronic complications (4, 6). Currently, there are no scientific proven drugs that can prevent gluten-induced mucosal damage in celiac patients. There are some studies showing that there is a significant relationship between increased celiac patients' adherence to GFD and reduced risk of malabsorption, osteoporosis, and some autoimmune diseases (4, 7, 8). Therefore, adherence to a lifelong GFD is very important in reducing the inflammatory process and mucosal damage in the intestines. In addition, adherence to GFD may reduce health expenditures due to complications that may develop due to celiac disease.

Celiac patients must cope with major changes in their eating habits and even in their social lives because GFD in CD is the only accepted treatment (9, 10). Further, it is very difficult to maintain GFD, which makes radical changes in eating habits, consistently throughout life (9). Lifelong strict adherence to a GFD is necessary to prevent complications. Nurses and specialist pediatric dietitians have an important role in recognizing and diagnosing CD early, as well as offering ongoing dietary and clinical support (11).

In previous studies, the most frequently reported reasons for the difficulties faced by celiac patients in adherence to GFD are the high costs of GFPs, difficulty to access GFPs (3, 12), not supporting by the other members of family (13), and dislike of the organoleptic properties of GFPs (4). In this study, it was aimed to determine the adherence to GFD and the related factors affecting social life in adults with CD.

MATERIAL AND METHODS

Study Design and sampling

This cross-sectional study was performed with adults diagnosed celiac disease in Kayseri province, a Central Anatolian Region city. The participants were local members of the Turkish Life with Celiac Association which is a member of the Association of European Celiac Societies (AOECS). In addition to the GFD, those who had to follow another diet for a different reason (pregnancy, lactation, or chronic disease) were excluded from the study. The local members of the Turkish Life with Celiac Association included a total of 112 officially registered celiac

Table 2. The celiac patients' adherence to GFD and other nutritional behaviors.

Items	n	%
Self-reported adherence to GFD		
Excellent	52	53.1
Poor	46	46.9
Number of consumed meals in a day		
2	35	35.7
3	63	64.3
Consumption of snacks		
0	32	32.7
1	35	35.7
2	25	25.5
3	6	6.1
Skipping meals		
Yes	60	61.2
No	38	38.8
Most skipped meal*		
Breakfast	14	23.3
Lunch	44	73.3
Dinner	2	3.4
Favorite food preferences for snacks**		
Fruits	44	66.6
Nuts	14	21.2
Dairy products	8	12.2
Regular use of vitamin-mineral supplements		
Yes	24	24.5
No	76	75.5
Total	**98**	**100.0**

* (n=60), those only who skip meals, and ** (n=66), those only who consumption snacks.

patients. In this study, it was aimed to reach the study population without a specific sample selection. However, 12 celiac patients refused to participate. They were therefore excluded. In addition, two celiac patients were excluded from the study due to errors in their data. As a result, this study was conducted using data from a sample size of 98 celiac patients.

To assess dietary adherence in celiac patients, G power analysis with a medium effect size was performed using a one-sample case test with α=0.05 and β=0.80. The sample size was determined as a minimum of 90 participants.

Data Collection

The data were collected between September 2017 and May 2018 by using telephone-interview method. The answers were recorded on the questionnaire forms by the researchers. After giving detailed information about the study, a suitable time was determined with the celiac patients to ensure the reliability of the data, and the telephone-interview was made during this time. The celiac patients who did not want to participate were not included in the study.

Adherence to GFD was the dependent variable, while various variables (age, gender, economic, educational, and marital status, etc.) were independent. A questionnaire consisting of three parts and 41 questions, developed by the researchers in accordance with the literature review was performed. In the first part, there were questions about the socio-demographic and disease characteristics, and anthropometric measurements of the celiac patients. In the second part, under the title of “adherence to gluten-free diet (GFD) and accessibility of gluten-free products (GFPs)”; it was aimed to determine the challenging situations to access GFPs and adapting and maintaining to the GFD. The questions under the title "Adherence to gluten-free diet (GFD) and accessibility to gluten-free products (GFPs)" were determined by analyzing the literature. Celiac patients were asked for their most recent measurements and their self-reports were obtained. The BMI was calculated from these values. Body mass index (BMI) (weight (kg)/height (m)²) was calculated from self-reported weight and height measurement values (14). Celiac patients with BMI < 18.5 kg/m2 were evaluated as “underweight”, 18.5-24.9 kg/m2 as “normal”, 25.0-29.9 kg/m2 as “overweight”, and ≥ 30.0 kg/m2 as “obese” (15).

For the categorization of adherence to the gluten-free diet, which is the most basic variable of the study; those who declared that they strictly adherence to GFD were characterized as "excellent" adherence, while those who declared all other conditions were characterized as "poor" adherence.

Statistical Analysis

Data was analyzed using SPSS 22.0 (SPSS Inc., Chicago, IL) package program. Data was tested with Shapiro-Wilk test for normal distribution. Percentage values were used for qualitative data. Student-t test was used to compare quantitative variables, and Chi-square test was used to compare qualitative variables. The factors that were significant in the Chi-square comparison of qualitative variables were evaluated by multiple logistic regression analysis. Multiple logistic regression analysis was performed to determine which variables affected “excellent”

Table 3. GFD and GFPs related issues experienced by the celiac patients

Items	n	%
Can you easily access GFPs?		
Yes	38	38.8
No	60	61.2
How often do you consume commercial GFPs?		
Everyday	15	15.3
Every other day	35	35.7
Never	48	49.0
How do you get GF bread?		
Purchasing from a market	36	36.7
Cooking by self	46	47.0
Both	16	16.3
What do you do while eating out?		
I only prefer the restaurants that have GF menus to eat out.	66	67.3
I go randomly.	20	20.4
I never eat out.	12	12.3
What do you think about the prices of commercial GFPs?		
Normal	4	4.1
Expensive	94	95.9
Do you easily access to commercial GFPs in every market?		
Yes	17	17.3
No	81	82.7
Do you use gluten-scanner applications?		
Yes	68	69.4
No	30	30.6
Total	**98**	**100.0**

adherence to GFD modelled by multiple logistic regression analysis with independent groups. Odds ratio (OR) at 95% confidence interval (CI) for every model was calculated. Values were considered significant at $p<0.05$.

Ethical Consideration

The study was approved by Nuh Naci Yazgan University Ethical Committee (Decision Date: 13.11.2017, No: 2017-338). Written permission was obtained from the Kayseri Life with Celiac Association to conduct the study and the procedures followed were in accordance with the Helsinki Declaration. The celiac patients who participated in the study were given detailed information about the study and were assured of the confidentiality of their responses. Verbal informed consent were provided.

RESULTS

In this study data of 98 celiac patients were evaluated. The mean age of the celiac patients was 36.22±12.28 years (min: 18, and max: 69 years). The celiac patients' 21.4% were men and 78.6% were women. According to the BMIs of the celiac patients, 11.2% were underweight, 52.1%, were normal, 24.5% were overweight and 12.2% were obese. The celiac patients' 74.5% were not working. Most of the celiac patients (68.4%) had high school and above education level. The celiac patients' 72.4% were married, 77.6% had ≥4 family members. 59.2% of the celiac patients had good economic status. The celiac patients' 61.2% had ≥10 diagnosed years and 53.1% had concomitant disease. The mean diagnosed years of the celiac patients was 29.50±12.69 years (Data not shown in a table). The celiac patients' 19.0% had a family member diagnosed with CD. The celiac patients' 58.2% evaluated their health status as "good". The celiac patients' sociodemographic, anthropometric, and disease characteristics were presented in the Table 1.

The celiac patients' adherence to GFD and other nutritional behaviors were showed in the Table 2. 53.1% of the celiac patients reported their adherence to GFD was "excellent", 46.9% was "poor". The celiac patients' 64.3% consume three main meals, and 35.7% consume one snack in a day. It was found that 61.2% of the celiac patients skipped some meals. The most skipped meal was lunch with the rate of 73.3%. The rate of fruit consumption as a snack was 66.6%. The proportion of using regular vitamin-mineral supplements among celiac patients was 24.5% (Table 2).

Table 3 shows GFD and GFPs related issues experienced by the celiac patients. The celiac patients' 61.2% reported difficulties about to access GFPs and 49.0% of them never consume commercial GFPs. The rate of those who baked the gluten-free bread themselves was 47.0%. Before eating out, 67.3% of the celiac patients call the restaurant to ask if they have a gluten-free menu. While 95.9% of the celiac patients stated that GFPs were expensive, 82.7% reported that they could not find GFPs in every market. The celiac patients' 69.4% reported that they use a gluten-scanner application. In addition, taste, odor, and texture evaluations of GFPs products were similar for age groups and genders (Data not shown in the table).

Table 4. Comparison of celiac patients' adherence to GFD according to some characteristics.

Items	Adherence to GFD						p
	Excellent (n=52)		Poor (n=48)		Total (n=98)		
	n	%	n	%	n	%	
Gender							
Male	10	47.6	11	52.4	21	21.4	0.573
Female	42	54.5	35	45.5	77	78.6	
Age groups (years)							
<35	21	46.7	24	53.3	45	45.9	0.334*
≥35	31	58.5	22	41.5	53	54.1	
BMI (kg/m^2)							
<24.9	29	46.8	33	53.2	62	63.3	0.154*
≥25.0	23	63.9	13	36.1	36	36.7	
Working status							
Working	17	68.0	8	32.0	25	25.5	0.133*
Not working	35	47.9	38	52.1	73	74.5	
Education status							
Less than high school	16	51.6	15	48.4	31	31.6	1.000*
High school and upper than high school	36	53.7	31	46.3	67	68.4	
Marital status							
Not married	13	48.1	14	51.9	27	27.6	0.708*
Married	39	54.9	32	45.1	71	72.4	
Number of family members							
<4	18	81.8	4	18.2	22	22.4	**0.005***
≥4	34	44.7	42	55.3	76	77.6	
Economic status							
Bad	7	53.8[a]	6	46.2[a]	13	13.3	**0.003**
Moderate	7	25.9[a]	20	74.1[b]	27	27.5	
Good	38	65.5[a]	20	34.5[a]	58	59.2	
Diagnosed years							
<10	33	86.8	5	13.2	38	38.8	**<0.001**
≥10	19	31.7	41	68.3	60	61.2	
Presence of concomitant disease							
Yes	27	51.9	25	48.1	52	53.1	0.970*
No	25	54.3	21	45.7	46	46.9	
Family members diagnosed with CD							
Yes	10	55.6	8	44.4	18	18.4	1.000*
No	42	52.5	38	47.5	80	81.6	
Self-reported health status							
Good	39	68.4	18	31.6	57	58.2	**<0.001***
Not good	13	31.7	28	68.3	41	41.8	
Regular use of vitamin-mineral supplements							
Yes	11	45.8	13	54.2	24	24.5	0.561*
No	41	55.4	33	44.6	74	75.5	
Can you easily access GFPs?							
Yes	27	69.2	12	30.8	39	39.7	**0.016***
No	25	42.4	34	57.6	59	60.3	
How often do you consume commercial GFPs?							
Everyday	9	60.0	6	40.0	15	15.3	0.191
Every other day	22	62.9	13	37.1	35	35.7	
Never	21	43.8	27	56.3	48	49.0	
How do you get GF bread?							
Purchasing from a market	17	47.2	19	52.8	36	36.7	0.566
Cooking by self	27	58.7	19	41.3	46	46.9	
Both	8	50.0	8	50.0	16	16.4	

Table 4. Continue

What do you do while eating out?							
I randomly eat out.	6	18.8	26	81.3	32	32.7	**<0.001**
I only prefer the restaurants that have GF menus to eat out.	40	71.4	16	28.6	56	57.1	
I never eat out.	6	60.0	4	40.0	10	10.2	
Do you use gluten-scanner applications?							
Yes	44	64.7	24	35.3	68	69.4	**0.001***
No	8	26.7	22	73.3	30	30.6	

[a, b]: Different letter indicates statistically significant difference.
Yates correction was made for p values with "*".

Comparison of celiac patients' adherence to GFD according to some characteristics is presented in Table 4. The rates of adherence to GFD in males and females were similar ("excellent" adherence to GFD 47.6% in males and 54.5% in females, "poor" adherence to GFD 52.4% in males and 45.5% in females, respectively). There was no significant relationship between age groups, BMI, working, education and marital status and adherence to GFD. Likewise, there was no significant relationship between diagnosed years, presence of concomitant disease, family members diagnosed with CD, regular use of vitamin-mineral supplements, how to get gluten-free bread. The rate of "excellent" adherence to GFD was significantly higher among the celiac patients could easily access GFPs ($p<0.05$). The rate of "excellent" adherence to GFD was significantly higher in celiac patients who have <4 persons in their family ($p<0.05$). "Poor" adherence to GFD was found to be significantly higher in those with moderate economic status ($p=0.003$). Furthermore, the rate of "excellent" adherence to GFD in celiac patients who reported "good health status" was found to be significantly higher than those with in celiac patients who reported "not good health status" ($p<0.001$). The rate of "poor" adherence to GFD was significantly higher in celiac patients with who were eating out randomly ($p<0.001$). Significantly lower "excellent" adherence to GFD was found in those who did not use a gluten-free scanner ($p=0.001$) (Table 4).

Multiple logistic regression analysis of the factors affecting "excellent" adherence to GFD in the celiac patients was showed in Table 5. The celiac patients' 69.4% reported that they used a gluten-scanner application. The rate of "excellent" adherence to GFD of the celiac patients who had ≥4 family members were significantly lower (OR: 0.112 CI: 0.15-0.832, $p=0.017$). The celiac patients with ≥10 diagnosis years had significantly lower adherence to GFD (OR: 0.053 CI: 0.010-0.292, $p=0.001$). Although adherence to the GFD was higher in those who never ate out (OR: 12.430 CI: 0.995-155.294, $p=0.003$), the result was not considered significant because the confidence interval included 1.00. Gluten-scanner applications non-users had 0.163-fold lower "excellent" adherence to GFD (OR: 0.163 CI: 0.034-0.779, $p=0.016$).

DISCUSSION

WHO defines adherence to a treatment as "the extent to which an individual's behavior, such as taking medication, following a diet, and/or making lifestyle changes, corresponds to the agreed-upon recommendations of a healthcare provider" (16). The previous studies on CD have reported there are too many factors affecting adherence to a GFD like socio-demographic characteristics, diagnosis age, practical barriers associated with GFD, and membership in a CD-related association (17, 18). Most of the studies on CD were predominantly focused to determine clinical perspective of the disease (19, 20), prevalence (21, 22), and quality of the life (23, 24) in celiac patients. To best of our knowledge, there are limited studies evaluating the impact of GFD on patients' social lives, some in children and adolescents, and some in adults (25, 26). Therefore, assessing the effects of GFD adherence on social life in a small group of people who were active memberships in a celiac-related association was worth investigating.

In the literature review, the adherence rates to GFD vary between 34%-95% (27). In this study, similar to the literature, 53.1% of celiac patients reported that their adherence to GFD was "excellent". Among the possible reasons for this variability, using different methods and the different characteristics of the study population (such as different diagnosis times, membership in a CD-related association, and several cultural factors, etc.). Therefore, population-specific

data is highly necessary. Also, the comparability between studies is also very limited.

Some recent studies indicated there were several difficulties to adherence a GFD which could affect BMI of celiac patients (18, 28). Some population-based studies showed that celiac patients unable to adapt to a GFD have malnutrition. On the other hand, some studies reported the rates of being obese among celiac patients' changes between 7.0-12.0% (29-31). A large cohort study conducted by Cheng et al. (29) reported 60.0% of the patients with CD had normal BMI, whereas 17.3% were underweight and 15.2% were overweight, and 6.8% obese. However, Drosdak et al. (32) reported the obesity prevalence in celiac patients as 45%, which is quite far from the other results. In this study, the rates of "underweight", "normal", "overweight" and "obese" of celiac patients were 11.2%, 52.1%, 24.5% and 12.2%, respectively, which supported the findings of Cheng et al. (29).

Involving family members in the management of CD is very important. The presence of a celiac patient at home who must follow a GFD will certainly affect whole eating practices at home. For the celiac patients to "excellent" adherence to a GFD, it is important that the prepared food does not contain and contaminated with gluten. Therefore, the support of family members becomes very important in the management of CD (33). We found "excellent" adherence to GFD of the celiac patients who had ≥4 family members were significantly lower (OR: 0.112 (0.15-0.832), $p<0.05$). van Overbeek et al. (13) reported that failure of family members without CD to adopt GFD would affect home-cooked meals, which in turn would affect the celiac patient's adherence to GFD. Our results showed that having fewer family members may be effective in supporting the dietary adherence of the celiac patient.

The prevalence of CD in first-degree relatives of celiac patients has been reported to be approximately 10.0% (33). The prevalence of CD in first-degree relatives of patients with celiac disease who participated in this study was found to be 19.0%. As the reason why this rate was higher than the rate stated in previous study; it was thought that the celiac patients in this study had more awareness because they are registered to an association working on CD.

The data about the relationship between economic status and CD are conflicting. Economic status may affect celiac diagnosis (34) and the celiac patient's adherence to GFD, purchasing power of GFPs, and quality of life (2, 3, 25, 26). In this study there was no significant relationship between the economic status of celiac patients' adherence to GFD. In a study conducted by Villafuerte-Gallez et al. (27) examining both quantitative and qualitative measures adherence to GFD, reported that median household income was not associated adherence to GFD. A multidimensional examination of the effect of economic dimension on adherence to GFD in celiac patients may be a research area for future studies.

The relationship between adherence to GFD and age at diagnosis has been reported in CD (12). In this study, instead of establishing the relationship between the age at diagnosis and adherence to GFD, when the effect of years after diagnosis on adherence to GFD was evaluated. It was shown that celiac patients with ≥10 diagnosis years had significantly lower adherence to GFD. Especially in newly diagnosed celiac patients, it is possible to experience tighter adherence to GFD due to the more frequent appointments with the dietitian or practitioner.

Difficulties accessing GFPs or risk of cross-contamination with gluten makes it challenging for celiac patients to eat out (35). A previous study highlighted the lack of gluten-free menu options when eating out as a cause of "poor" adherence to GFD (27). To social support of celiac patients, who are a disadvantaged group in participating in social activities such as eating out, local governments' efforts to create and increase gluten-free menu options in restaurants will be an approach that will be appreciated for celiac patients of all age groups.

Best of our knowledge, there are limited studies investigating the relationship between mobile GFD application use and dietary adherence to GFD (36, 37). Notably, there is a need for future intervention studies that examine in detail the use of mobile application and wearable technologies in the management of celiac and even other chronic diseases. In fact, intervention studies can be designed with the use of mobile applications and wearable technologies, especially to increase adherence to GFD. It is to demonstrate that active memberships in a celiac-related association who must follow a strict diet constantly increase their adherence to their diet with the use of the application.

Limitations

There are some limitations in this study. The first of these is the adherence to GFD was obtained only through self-assessment of CD patients and the study included local results. Supporting the

adherence to GFD not only with the expressions of celiac patients or any measurement tool, but also with serological tests will reveal more information. Symptom frequency, food consumption record or food consumption frequency were not questioned. Questioning of symptom frequency may be an important factor revealing the dietary adherence of celiac patients. Future studies can be planned by considering these limitations. However, this study also has an important strength. To the best of our knowledge, this is the first study to emphasize the relationship between mobile GFD application use and dietary adherence to GFD in Turkey.

CONCLUSION

This study showed that adherence to GFD in celiac patients increased with family support, new diagnosis of celiac disease, lack of eating out habits and mobile application use. Based on these results, in order to increase adherence to GFD, nutrition education should be given to family members, gluten-free meals should be included in restaurant menus by local municipalities. The widespread use of gluten-free mobile applications may facilitate the management of medical nutrition therapy.

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REFERENCES

1. Roka V, Potamianos SP, Kapsoritakis AN, et al. Prevalence of celiac disease in the adult population of central Greece. Eur J Gastroenterol Hepatol 2007;19(11):982-987.
2. Lee AR, Ng DL, Zivin J, et al. Economic burden of a gluten-free diet. J Hum Nutr Diet 2007;20(5):423–430.
3. Lee AR, Wolf RL, Lebwohl B, et al. Persistent economic burden of the gluten free diet. Nutrients 2019;11(2), 399.
4. Demir E, and Comba A. The evolution of celiac disease publications: A holistic approach with bibliometric analysis. Ir J Med Sci 2020;189:267–276.
5. Ryan M, and Grossman S. Celiac disease: Implications for patient management. Gastroenterol Nurs 2011;34(3):225–228.
6. Gutowski ED, Weiten D, Green KH, et al. Can individuals with celiac disease identify gluten-free foods correctly? Clin Nutr ESPEN 2020;36:82–90.
7. Catassi C, Fabiani E, Corrao G, et al. Italian Working Group on Celiac Disease and Non-Hodgkin's-Lymphoma. Risk of non-Hodgkin lymphoma in celiac disease. JAMA 2002;287(11):1413–1419.
8. Kemppainen T, Kröger H, Janatuinen E, et al. Osteoporosis in adult patients with celiac disease. Bone 1999;24(3):249–255.
9. Barberis N, Quattropani MC, and Cuzzocrea F. Relationship between motivation, adherence to diet, anxiety symptoms, depression symptoms and quality of life in individuals with celiac disease. J Psychosom Res 2019;124:109787.
10. Arias-Gastelum M, Cabrera-Chávez F, Vergara-Jiménez MDJ, et al. The gluten-free diet: Access and economic aspects and impact on lifestyle. Nutr Diet Suppl 2018;10 (27):34.
11. Paul SP, Ranjan A, Bremner G, et al. () Diagnosis and management of celiac disease in children. Br J Nurs 2021;30(13):6-10.
12. do Nascimento AB, Fiates GMR, dos Anjos A, et al. Gluten-free is not enough perception and suggestions of celiac consumers. Int J food Sci Nutr 2014;65(4):394–398.
13. van Overbeek FM, Uil-Dieterman IG, Mol IW, et al. The daily gluten intake in relatives of patients with celiac disease compared with that of the general Dutch population. Eur J Gastroenterol Hepatol 1997;9(11):1097-1099.
14. World Health Organization, 1998 [Internet]. Obesity: Preventing and Managing the Global Epidemic [Accessed date: 12 September 2018] Available from: https://apps.who.int/iris/handle/10665/42330
15. WHO Expert Consultation, 2004. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet (London, England), 363(9403):157-163.
16. World Health Organization, 2003) [Internet]. Adherence to long-term therapies: Evidence for action. [Accessed date: 14 September 2018] Available from: https://apps.who.int/iris/handle/10665/42682

17. Leffler DA, Edwards-George J, Dennis M, et al. Factors that influence adherence to a gluten-free diet in adults with celiac disease. Dig Dis Sci 2008;53(6):1573–1581.
18. Muhammad H, Reeves S, Jeanes YM. Identifying and improving adherence to the gluten-free diet in people with celiac disease. Proc Nutr Soc 2019;78(3):418-425.
19. Yaşar S, Yaşar B, Abut E, et al. Clinical importance of celiac disease in patients with recurrent aphthous stomatitis. Turk J Gastroenterol 2012;23(1):14-8.
20. Unal E, Demiral M, Baysal B, et al. Frequency of celiac disease and spontaneous normalization rate of celiac serology in children and adolescent patients with type 1 diabetes. J Clin Res Pediatr Endocrinol 2021;13(1):72-79
21. Dogan B, Oner C, Bayramicli OU, et al. Prevalence of celiac disease in adult type 1 patients with diabetes. Pak J Med Sci 2015;31(4):865-868.
22. Bengi G, Cıvak M, Akarsu M. Prevalence of celiac disease in patients with inflammatory bowel disease in Turkish population. Gastroenterol Res Pract 2019;6272098.
23. Sevinç E, Çetin FH, Coşkun BD. Psychopathology, quality of life, and related factors in children with celiac disease. J Pediatr 2017;93(3):267-273.
24. Oflu AT, Bukulmez A, Icigen E, et al. Life quality and empathy in children with celiac disease. North Clin Istanb 2020;7(6):557-562.
25. Zysk W, Głąbska D, Guzek D. Social and emotional fears and worries influencing the quality of life of female celiac disease patients following a gluten-free diet. Nutrients 2018;3;10(10):1414.
26. Serin Y and Akbulut G. The impact of gluten-free diet on the lifes of individuals with celiac disease: A Turkish perspective. Beslenme ve Diyet Dergisi 2021;49(1):48-56.
27. Villafuerte-Galvez J, Vanga RR, Dennis M, et al. Factors governing long-term adherence to a gluten-free diet in adult patients with celiac disease. Aliment Pharmacol Ther 2015;42(6):753-60.
28. Pedoto D, Troncone R, Massitti M, et al. Adherence to gluten-free diet in celiac paediatric patients assessed through a questionnaire positively influences growth and quality of life. Nutrients 2020;12(12):3802.
29. Cheng J, Brar PS, Lee AR, et al. Body mass index in celiac disease: beneficial effect of a gluten-free diet. J Clin Gastroenterol 2010;44(4),267-271.
30. Tortora R, Capone P, De Stefano G, et al. Metabolic syndrome in patients with celiac disease on a gluten-free diet. Aliment Pharmacol Ther 2015;41:352-9.
31. Stein AC, Liao C, Paski S, et al. Obesity and cardiovascular risk in adults with celiac disease. J Clin Gastroenterol 2016;50:545–50.
32. Drosdak A, Satyavada S, Ismail M, et al. Obesity prevalence in celiac disease in the United States from 2014 to 2018. Int J Obes 2021;46:441–443.
33. Ludvigsson JF, Card T, Ciclitira PJ, et al. Support for patients with celiac disease: A literature review. United European Gastroenterol J 2015;3(2):146-159.
34. Olén O, Bihagen E, Rasmussen F, et al. Socioeconomic position and education in patients with coeliac disease. Dig Liver Dis 2012;44(6):471–476.
35. Rodrigues M, Yonamine GH, Fernandes Satiro CA. Rate and determinants of non-adherence to a gluten-free diet and nutritional status assessment in children and adolescents with celiac disease in a tertiary Brazilian referral center: A cross-sectional and retrospective study. BMC Gastroenterol 2018;18(1):15.
36. Dowd AJ, Warbeck CB, Tang KT, et al. MyHealthyGut: Findings from a pilot randomized controlled trial on adherence to a gluten-free diet and quality of life among adults with celiac disease or gluten intolerance. Digit 2020;6:2055207620903627.
37. Meyer S, and Naveh G. Mobile application for promoting gluten-free diet self-management in adolescents with celiac disease: Proof-of-concept study. Nutrients 2021;13(5):1401.