

Celiac Disease and Its Links to Mental Health, Bullying, and Problematic Eating Behaviors: A Narrative Review with a Focus on Gender Differences

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ABSTRACT

Celiac disease (CD) is an autoimmune disease where damage to the small intestine and malabsorption of nutrients can occur because of the consumption of gluten, a protein found in wheat, barley, or rye. CD is associated with poorer mental health in children, adolescents, young adults, and adults compared to individuals without CD. In women with CD, mental health outcomes tend to be worse than men, particularly increased anxiety and lower psychological well being. This review aims to understand the burden of mental health issues related to CD, particularly anxiety, depression, disordered eating behaviors, bullying and social challenges, and gender-based differences. This review is based on published literature from 1998 and 2025, identified through searches on PubMed. This information is organized in tables for comparison. People with CD are likely to develop anxiety, depression, and problematic eating behaviors. Bullying and social challenges may lead to difficulties in following a GFD. Additionally, this is linked to self-perception and performance in children and adolescents with CD. These challenges affect the mental well-being and may influence the ways in which people cope with the challenges such as abnormal eating behaviors.

INTRODUCTION

Celiac disease (CD) is an autoimmune disease where damage to the small intestine and malabsorption of nutrients can occur because of the consumption of gluten, a protein found in wheat, barley, or rye. The prevalence of CD is estimated to be 0.5% to 1% in different regions of the world. Extraintestinal symptoms of CD are anemia, osteoporosis, dental enamel hypoplasia, and neurological symptoms. The common symptoms include weight loss, diarrhea, and steatorrhea, although some people may not show noticeable symptoms, making the diagnosis difficult. The management of CD involves adherence to a life-long gluten-free diet (GFD).¹ According to King et al. (2019), based on pooled incidence data from 1990-2016, the incidence of CD was 17 cases per 100,000 person-years for females and 7.8 per 100,000 person-years for males, suggesting a higher incidence among females.²

CD can lead to poorer mental health outcomes, including anxiety, depression, problematic eating behaviors, and in some cases bullying. Women with CD face more psychological distress than men, specifically more anxiety and reduced well-being. Additionally, CD has familial and societal costs. For example, families have to face challenges and burdens when caring and supporting an individual with CD. Satherley et al. (2000) found that parents caring for children with CD face greater responsibilities and anxieties relating to the health of their child. It was also found that caregivers may face challenges to parental well-being such as changes to social activities and economic stress.³

Although individuals with CD may be more prone to mental health issues such as anxiety, depression, and other mental health challenges, it is unknown whether it is greater in adolescents and young adults compared to children and older adults.

This review aims to examine the mental health outcomes of children, adolescents, young adults, and adults living with CD, specifically anxiety, depression, problematic eating behaviors, bullying, and the risk of psychological burdens between the genders. Studies have shown that individuals with CD tend to have higher psychological burdens compared to those without the condition. Some studies have shown that females living with CD are at higher risk of anxiety compared to males, but the reason is unclear. This review also aims to examine how bullying and social challenges in children and adolescents with CD may lead to difficulties in following a GFD. Additionally, this is linked to self-perception and performance in children and adolescents

DATA

Data Sources.

I completed a narrative review of MEDLINE's PubMed between January 2025 to May 2026. The indexed and free-text search terms included 'celiac disease,' 'mental health,' 'anxiety,' 'depression,' 'bullying,' 'problematic eating behaviors,' and 'gender differences.' The terms were combined using "AND" and "OR".

Study Selection.

Studies were selected based on the following inclusion criteria: [1] assessed the relationship between celiac disease and one or more mental health, behavioral, or social outcomes and [2] published between 1998 and 2025. The studies included cross-sectional, case-control, qualitative, descriptive and correlational, population-based cohort, population-based observational, and nationwide registry-based matched cohort studies, and semi-structured interviews, with no restrictions on study setting, participant age group, or location of study. The studies the review included were limited to English. To determine whether the studies would be included in the review, the abstracts were first reviewed to see if it fit into the inclusion criteria. Exclusion criteria included: [1] not focused on celiac disease; [2] did not assess

association with mental health, behavioral, or social outcomes or [3] not original research (e.g., news articles, op-eds, letters to the editor).

RESULTS

Study	Design	Population	Setting	Outcome	Excess risk
Butwicka et al. (2017) ⁴	Nationwide registry-based matched cohort study	10,903 children (<18 years) diagnosed with CD and 12,710 siblings without CD	Sweden	A psychiatric disorder was found in 843 children with CD during follow-up	Children with CD had a 1.4-fold increased risk of developing psychiatric disorders such as mood disorders, anxiety disorders, eating disorders, behavioral disorders, ADHD, ASD, and intellectual disability.
Häuser et al. (2010) ⁵	Observational cross-sectional study	441 adults with CD (on GFD), 235 with inflammatory bowel disease, and 441 from the general population	Germany (German Celiac Society and general population sample)	Levels of anxiety, depression, and the prevalence of anxiety and depression disorders using Hospital Anxiety and Depression Scale	Adults with CD had higher levels of anxiety and a greater likelihood of anxiety disorders (CD: 16.8% vs General Population: 5.7%), while no particular risk was observed for depression.
Alkhayyat et al. (2021) ⁶	Population-based observational study (retrospective, multicenter database)	112,340 patients with CD identified from 37,465,810 patients	USA; multicenter Electronic Health Record database from 26 integrated healthcare systems (2016–2020), 360 hospitals	History of psychiatric disorders including anxiety, depression, bipolar disorder, ADHD, eating disorders, and autism.	Compared to people who did not have any past experiences of CD, individuals with CD had greater chances of developing anxiety disorder (OR = 1.385; 95% CI: 1.4–1.4) and depression disorder (OR = 1.9; 95% CI: 1.9–1.9), including other psychiatric disorders.
Ludvigsson et al. (2006) ⁷	General population-based cohort study	13,776 individuals with CD, matched with 66,815 age- and sex-matched controls	Sweden; nationwide population-based registers	Subsequent depression, bipolar disorder, and prior mood disorders	Individuals with CD had a greater risk of developing depression (HR = 1.8; 95% CI: 1.6–2.2), but not bipolar disorder (HR = 1.1; 95% CI: 0.7–1.7).

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Lebwohl et al. (2021) ⁸	Population-based cohort study	19,186 children with biopsy-confirmed CD diagnosed between 1973–2016, matched with 94,249 controls	Sweden; data from the Epidemiology Strengthened by histoPathology Reports in Sweden cohort	Psychiatric disorders, including mood disorders, anxiety disorders, eating disorders, ADHD, and autism spectrum disorder; assessed by diagnosis recorded in the Swedish national patient register diagnoses	Childhood CD is associated with increased risk of psychiatric disorders (HR = 1.2; CI: 1.1–1.2). Specifically, increased risk for mood disorders (HR = 1.2; 95% CI: 1.1–1.3) and anxiety disorders (HR = 1.1; 95% CI: 1.1–1.2) that persists into adulthood.
Joelson et al. (2018) ⁹	Cross-sectional analysis	519 adults with CD (86% female and mean age was 40.9 years)	United States; participants recruited via patient-powered research network (iCureCeliac [®])	Depressive symptoms were common and changed the relationship between celiac symptom severity and GFD adherence.	46% of adult celiac patients reported at least moderate depressive symptoms (“somewhat,” “quite a bit,” or “very much”) related to their disorder, indicating a high burden of depression in the CD population.
Ali et al. (2023) ¹⁰	Cross-sectional study	133 adults with diagnosed CD	Jordan; patients recruited via the Friends of Celiac Disease Patients Association through WhatsApp/Google Forms	Anxiety and depressive symptoms measured using validated Arabic versions of the Generalized Anxiety Disorder-7 and Patient Health Questionnaire-9	High prevalence of anxiety (85%) and depression symptoms (83%) in adult patients with CD.
Germone et al. (2022) ¹¹	Cross-Sectional Study	175 children aged 8–17 years with biopsy-proven CD	Clinical study group in pediatric practice comprising children diagnosed with CD based on the Revised	Anxiety and depression symptoms in children with CD	39% of children with CD showed signs of clinically relevant anxiety and/or depression.

			Children's Anxiety and Depression Scale		
Belpinar et al. (2023) ¹²	Descriptive and correlational study	98 children diagnosed with CD	Pediatric outpatient clinic of a university hospital in Eastern Anatolia, Turkey (September 2021 – August 2022)	Measured anxiety and depression levels utilizing the State-Trait Anxiety Inventory, Depression Scale, and Quality of Life Scale via face-to-face interviews	Children with CD showed high levels of anxiety and depression, along with psychosocial health problems and impaired physical functioning.
Carta et al. (2015) ¹³	Case-control study	60 patients with CD (10 men, 50 women) and 240 age-and sex-matched controls without CD.	Gastroenterology Unit, University Hospital of Cagliari, Italy	Lifetime prevalence of Major Depressive Disorder and panic disorder in patients with CD compared with controls using a structured neuropsychiatric assessment schedule	High prevalence of Major Depressive Disorder (30% vs 8.3%, $P<0.0001$) and panic disorder (18% vs 5.4%, $P<0.001$) in CD compared with controls, indicating risk of depression and anxiety disorders in CD.
Ciacchi et al. (1998) ¹⁴	Cross-sectional observational study	Adult cohort in a clinical research setting including 92 patients with CD, 100 normal controls, and 48 chronic persistent hepatitis patients.	A clinical comparison study of CD patients, healthy controls, and patients with chronic persistent hepatitis	Depressive symptoms measured using a modified Zung Self-Rating Depression Scale	Individuals with CD had higher scores for depressive symptoms compared to normal controls. Presence of depressive symptoms in CD irrespective of age of diagnosis, disease duration, and diet adherence.
Sarica et al. (2025) ¹⁵	Case-control study	Ages 12-18 years, biopsy-proven CD and age-and sex-matched normal subjects	Pediatric Gastroenterology Unit University Hospital (Türkiye)	Depression and anxiety in adolescents with CD compared with healthy controls	Depression scores were highest among adolescents with CD who were non-adherent to a GFD (29), followed by CD adherent (8),

					and healthy controls (2), measured using the Kovacs Depression Inventory.
Akkus et al. (2025) ¹⁶	Case-control study	129 participants (64 with CD and 65 controls), ages 8-18	Necmettin Erbakan University, Konya, Turkey	Quality of life, anxiety, and depression	No significant difference in depression or state anxiety. However, trait anxiety was significantly higher, and quality of life significantly lower.

Table 1: Studies on Depression and Anxiety in Individuals with Celiac Disease (CD)

Abbreviations: ADHD=Attention deficit hyperactivity disorder; ASD= Autism Spectrum Disorder; CD=Celiac Disease; GFD= Gluten-Free Diet; HR= High Risk; CI= Confidence Interval.

Depression & Anxiety. CD is associated with an increased risk of anxiety and depression in various populations and age groups. Large cohort studies have been conducted on children to determine this risk. For example, a study published by Butwicka et al. (2017) found that in 10,903 Swedish children with CD, 843 children with CD had a psychiatric disorder. This shows there is a 1.4-fold increased risk of psychiatric disorders, including mood and anxiety disorders. In another study, Lebwohl et al. (2021) reported increased risk of mood disorders (HR = 1.2; 95% CI: 1.1–1.3) and anxiety disorders (HR = 1.1; 95% CI: 1.1–1.2) in a cohort of 19,186 children with CD. This increased risk was seen to persist even after adulthood. Additionally, according to Germone et al. (2022), using the Revised Children’s Anxiety and Depression Scale, 39% of children with CD demonstrated clinically relevant anxiety and/or depression. Similarly, Belpinar et al. (2023) found that 98 patients with CD in Eastern Anatolia, Turkey, had elevated symptoms of anxiety and depression, as well as psychosocial and physical functioning difficulties, using the State-Trait Anxiety Inventory, Depression Scale, and Quality of Life Scale via face-to-face interviews. Similar findings have also been reported in adolescents. Sarica et al. (2025) reported that depression scores were highest among adolescents with CD who were non-adherent to a GFD (29), followed by CD adherent (8), and healthy controls (2), measured using the Kovacs Depression Inventory. In general, these findings suggest that CD, particularly if there is nonadherence to a diet, is associated with an increased risk of depressive symptoms. In adults, various studies have been conducted among different populations, supporting this association. Alkhayyat et al. (2021) using Electronic Health Record data reported higher likelihood of anxiety (OR = 1.385; 95% CI: 1.4-1.4) and depression (OR = 1.9; 95% CI: 1.9-1.9), as well as other psychiatric disorders, among 112,340 U.S. CD patients compared with individuals without CD. Ludvigsson et al. (2006) reported an increased risk of mood disorders such as depression (HR = 1.8; 95% CI: 1.6–2.2) among 13,776 Swedish individuals with CD. However, there was no significant association seen between CD and bipolar disorders. According to Joelson et al. (2018), 46% of adults with CD exhibited moderate to severe depression on a five-point scale, showing a significant prevalence of depression among adults with CD. Ciacci et al. (1998) similarly found elevated depressive symptoms in adults with CD, using a modified version of the Zung Self-Rating Depression

Scale. Carta et al. (2015) found a higher prevalence of Major Depressive Disorder (30% vs 8.3%, $P<0.0001$) and panic disorder (18% vs 5.4%, $P<0.001$) among adults with CD, using a structured neuropsychiatric assessment schedule. Ali et al. (2023), using Generalized Anxiety Disorder-7 and Patient Health Questionnaire-9, also found a higher prevalence of anxiety (85%) and depression (83%) among adults with CD. According to Häuser et al. (2010), anxiety disorders are more prevalent in adult patients with CD than in the general public (16.8% compared to 5.7%), with no increase in depression found by the use of Hospital Anxiety and Depression Scale. Lastly, Akkus et al. (2025) found higher levels of trait anxiety and lower quality of life in CD individuals. However, no significant difference was found in depression and state anxiety.

Study	Design	Population	Setting	Outcome	Excess Risk
Sahin et al. (2024) ¹⁷	Qualitative study	14 school-age d children with CD	Schools in a rural city, face-to-face interviews	Individual, environmental, and institutional were the main components influencing school experiences for children. Children faced bullying, discrimination, challenges adhering to a GFD, lack of awareness, and limited gluten-free options.	Children face emotional, cognitive, and behavioral challenges when managing a GFD and CD in school environments due to stigma, social withdrawal, or embarrassment.

Table 2: Studies on School and Social Challenges in Children with Celiac Disease (CD)

Abbreviations: CD= Celiac Disease; GFD=Gluten-Free Diet.

Bullying and Social Challenges in Celiac Disease. Based on a qualitative study by Sahin et al. (2024), three key factors influencing the school experience of children are individual, environmental, and institutional. Specific factors included in these themes that children can face include bullying, discrimination, lack of awareness, challenges to follow a GFD, and limited gluten-free options. The outcomes of these factors can lead to stigmatization from individuals in school due to lack of awareness, social withdrawal, and feelings of embarrassment which is linked to self-perception and performance among children. Challenges to manage a GFD is another result.

Study	Design	Population	Setting	Outcome	Excess Risk
Abed et al. (2025) ¹⁸	Case-control study	226 adults with CD and	Palestine; online	Depression, anxiety, stress, and eating	Individuals with CD had higher scores for depression, anxiety, and

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		healthy controls	questionnaire via Google Forms	behaviors in CD patients compared to healthy controls (using Depression, Anxiety, Stress Scale-21 items, and Eating Behaviors Reference for Adults questionnaire).	stress compared with healthy subjects. Eating behavior disturbances were also observed and included reduced satisfaction and altered satiety responses.
Passananti et al. (2013) ¹⁹	Case-control study	100 untreated adults with CD and 100 healthy controls	Italy; outpatient clinics for gastroenterology University of Naples Federico II, University of Salerno, 2011-2012.	People with CD showed more disordered eating than healthy controls.	Individuals with untreated CD showed higher scores of altered eating behaviors (e.g., thinness concerns, perfectionism, and interpersonal insecurity) compared with controls, along with increased anxiety and depression.
Lee et al. (2021) ²⁰	Cross-sectional study	538 adults with CD on a GFD	USA; Email recruitment for Celiac Disease Center (Columbia University Medical Center), using Qualtrics online survey, 2020	Eating behaviors, social anxiety, and quality of life	Individuals who had adhered to a GFD for a shorter time (1-4 years) experienced maladaptive eating attitudes and behaviors, lower quality of life, and higher social anxiety compared to those who had followed the diet for 10 years or longer.
Cadenhead et al. (2019) ²¹	Cross-sectional cohort study	30 adolescents with CD, 13-17 years, on GFD ≥ 1 year	Celiac Disease Center, USA	Eating behaviors and quality of life are measured	53% of participants following a GFD experienced maladaptive eating behaviors such as rigidity, avoidance, controlling behaviors, and preoccupation with a lower quality of life.

Table 3: Studies on Problematic Eating Behaviors in Individuals with Celiac Disease (CD)

Abbreviations: CD= Celiac disease; GFD=Gluten-Free Diet.

Problematic Eating Behaviors. There is some empirical evidence indicating that CD may be correlated with maladaptive eating patterns, which in some cases have been found among individuals following a GFD. These factors may be associated with poorer psychological well-being. In the study conducted by Abed et al. (2025), subjects diagnosed with CD in Palestine had high scores in eating behavior disturbances like reduced satisfaction and satiety reactions. Additionally, the results were associated with elevated scores of anxiety, depression, and stress, as measured using the online survey conducted using Google Forms. Similarly, in a study conducted by Passananti et al. (2013) Italian adults with untreated CD showed higher scores of eating behaviors than their control subjects who are healthy. Specifically, people with CD had more concerns about thinness, perfectionism, and interpersonal insecurity along with increased anxiety and depression. The study by Lee et al. (2021) identified more maladaptive eating behaviors among 538 US individuals who had followed a GFD for a shorter period of time. Lastly, in a study conducted by Cadenhead et al. (2019), 53% of adolescents with CD adhering to a GFD found to have maladaptive patterns such as rigidity, avoidance, controlling behaviors, and preoccupation. Findings also found that CD individuals experienced a lower quality of life.

Study	Design	Population	Setting	Outcome	Excess Risk
Rostami-Nejad et al. (2020) ²²	Cross-sectional study	283 CD patients (190 female, 93 male)	9 centers across Iran, 2016–2018	Anxiety assessed using Zung Self-Rating Anxiety Scale	Women reported higher overall anxiety levels compared to men. Women reported more feelings of upset/panicky compared to men. Women reported more tremors in arms and legs, headaches, neck and back pain, numbness and tingling in fingers and toes, dizzy spells, and facial hot flushes, compared to men. Overall, 67.8% of patients experienced anxiety symptoms, indicating a high prevalence in this population.
Roos et al. (2006) ²³	Observational cohort study	51 CD adults (59% women), aged 45–64 years diagnosed in 1984-1988; 182 population controls (57%	Sweden	Psychological well-being measured using the Psychological General Well-being index	Generally, people with CD had a similar degree of mental well-being including anxiety and depression as did the control group (103, 95% CI: 99-107 vs 103, 95% CI: 100-106). However, women with CD showed a significant difference in well-being compared to their male counterparts (97, 95% CI: 91-103 vs 111, 95% CI: 106-117).

		women)			
Rodrguez-Almagro et al. (2019) ²⁴	Qualitative study	22 women with CD aged 16-75	Semistructured interviews, Spain	Mental health and social quality of life	Women experienced lower mental and social quality of life with issues including feelings at diagnosis, impact on daily life, social perceptions of the illness, and personal meanings associated with CD. Overall, the experience reflected an effort to achieve normalcy.

Table 4: Studies on Sex Differences in Mental Health Outcomes in Individuals with Celiac Disease (CD)

Abbreviations: CD= Celiac Disease; CI= Confidence Interval.

Poorer Mental Health Outcomes in Women. In all the studies, the mental health outcomes for women with CD have been found to be worse compared to men. Rostami-Nejad al. (2020) found that anxiety levels of women in Iran with CD are higher compared to men. The levels of feeling upset/panicky, headaches, dizziness, tremors, back and neck pain, and facial hot flushes are also higher among women with CD compared to men. Another study done by Roos et al. (2006) found that the Psychological General Well-Being Index was significantly lower among women with compared to men with CD (97, 95% CI: 91-103 vs 111, 95% CI: 106-117), indicating that mental health outcomes for women with CD are lower compared to men. However, individuals with CD did not show higher levels of depression or anxiety compared to controls. Finally, Rodrguez-Almagro et al. (2019) found that mental health and social quality of life for women with CD are lower compared to men. Women face a lot of challenges that men with CD do not face such as feelings at diagnosis, impact on daily life, social perceptions of the illness, and personal meanings associated with CD.

DISCUSSION

This literature review shows that individuals with CD are more likely to develop mental health issues, such as anxiety and/or depression disorders, when compared to those without the condition.^{6,11,14} Studies illustrate potential biological and psychological contributing factors resulting in psychiatric factors. Specifically, mood, anxiety, and depression may be associated with vitamin deficiencies, malnutrition, inflammation, and burden of adhering to a GFD.^{4,7} Similarly, Lebwohl et al. (2021) indicated similar psychological burden and stress factors that are direct links to psychiatric disorders. This study aligns closely with Butwicka et al. (2017) study, while elaborating on the findings through a larger sample size and longer follow-up period.²⁵ A cross-sectional study by Joelson et al. (2018) indicates a potential possibility of depression in CD individuals worsening symptoms and this could be visible.⁹ Ali et al. (2023) report findings consistent with Häuser et al. (2010) results such as the similarity in the prevalence of anxiety in CD individuals, except gender differences as the study did not find greater anxiety in women

than men.¹⁰ In contrast, Rostami-Nejad et al. (2020) reported a lower anxiety prevalence compared to the two studies.²² In a study of 98 children diagnosed with CD, Belpinar et al. (2023) found difficulty and burden associated with adhering to a GFD and poorer quality of life as possible links to psychological disorders.¹² A case-control study in Italy by Carta et al. (2015) highlights the need for further research to determine whether lower quality of life is partially or entirely the result of psychiatric disorders. Similarly to Ali et al. (2023) findings, no gender differences were found in psychiatric disorders specifically anxiety and depression in Sarica et al. (2025) study. Further research is still needed to find how anxiety and depression disrupts adolescents' daily lives. Body dissatisfaction when following a GFD can possibly correlate to anxiety and depression. Specifically, this can lower self worth, perceived inadequacy, reduced social engagement, etc increasing the chance of experiencing depression and anxiety. Additionally an increase in anti-tTG-IgA levels may be associated with body image dissatisfaction which indirectly may be linked to anxiety or depression. Further research is needed to be conducted to find out the relationship between anxiety and adults with CD. Non-adherence to a GFD experienced the highest levels of anxiety and depression, followed by adherence to a GFD, while healthy controls had the lowest levels.¹⁵ Roos et al (2006) found no difference in anxiety and depression in CD individuals compared to controls using the Psychological General Well-being index.²³ Similarly, Akkus et al. (2025) found higher levels of trait anxiety and lower quality of life. However, no significant difference was found between depression and state anxiety. This means CD may be associated with long-term anxiety and less likely depression. The author states these findings may be influenced by the daily adherence to a GFD and how it can take a toll in daily life and social situations.¹⁶ Lastly, Häuser et al. (2010) provides one possible explanation for why they found higher levels of anxiety but not depression among adults with CD. The possible explanation is that following a GFD may improve psychological symptoms by reducing malabsorption of nutrients such as tryptophan. However, these benefits may offset the financial burden, social restrictions, and disease-related worries associated with adhering to a GFD.⁵

Sahin et al. (2024) found that children face emotional, social, and behavioral challenges specifically within school environments regarding relationships and activities. This suggests that participating and engaging in social environments influence how children manage a GFD. The author highlights the importance of awareness among teachers, nurses, and principals to help with providing appropriate support for the children and helping to manage an individual's GFD.¹⁷

A case-control study by Abed et al. (2025) found that CD eating pace, food enjoyment, and satiety responsiveness were affected in individuals with CD in Palestine. Results also found that CD impacts mental health. However, poorer mental health in individuals with CD is not the direct cause of abnormal eating patterns. This finding suggests that CD may extend beyond mental health and influence eating behaviors.¹⁸ Similarly, a case-control study conducted in Italy by Passananti et al. (2013) found several possible factors that may explain the greater occurrences of eating disorders in individuals with untreated CD. The possible factors include gastrointestinal symptoms such as functional bowel disorders, high carbohydrate intake, psychological factors that are associated with CD, and possibly hormones or other blood-borne mediators. A limitation of the study is that further research is needed to determine how adherence to a GFD plays a role in eating disorders.¹⁹ Among 538 adults with CD on a GFD, Lee et al.

(2021) found that the eating behaviors were more common among CD individuals that adhered to a GFD for a shorter period of time. This suggests adapting to a specific diet takes time to adjust and may initially lead to the higher levels of maladaptive eating behaviors. A potential confounding factor of this study is women were the majority of the participants in the study.²⁰ Lastly, a cross-sectional cohort study by Cadenhead et al. (2019) indicates additional possible factors influencing maladaptive eating behaviors which include personality traits, self-efficacy, the ability to adapt to challenging situations, internality, coping strategies, knowledge of CD and the GFD, environmental and social support, the ability to follow a GFD without it feeling burdensome, the ease of managing a GFD, and level of adherence to the GFD.²¹

Women are found to have higher levels of anxiety compared to men. Findings by Roos et al. (2006) found that women with CD had lower psychological well-being than men in Sweden across 51 CD individuals diagnosed in 1984-1988. These results may be related to women having a greater disease-related burden than men impacting on social activities and other important aspects of daily life. Another factor includes higher levels of gastrointestinal symptoms that women are more likely to experience than men influencing a lower psychological well-being in women.²³ Similarly, Rostami-Nejad et al. (2020) found that higher anxiety levels were in women compared to men in the Iranian population, with an overall anxiety prevalence of 67.8% in 283 CD individuals. The authors suggested that one possible reason behind the higher prevalence of anxiety in women may be their longer duration of adherence to a GFD compared with men of the participants in the study. Additionally, disease-related worries and how they can impact daily life and social situations may also contribute to higher levels of anxiety. Specifically women faced more feelings of upset/panicky, more tremors in arms and legs, headaches, neck and back pain, numbness and tingling in fingers and toes, dizzy spells, and facial hot flushes, compared to men.²² Lastly, Rodriguez-Almagro et al. (2019) found that women with CD experience lower mental and social quality of life among 22 women in Spain. The author suggests that this may be related to the impact of the disease on women's lives specifically through 4 experiences identified in their findings, which are feelings at diagnosis, social perceptions, impact on daily life, and personal meanings of CD. These experiences may influence greater anxiety in women than men.²⁴ Further research is needed due to the limited number of studies focused on gender differences.

These findings give useful information for making public policy. First, the mental wellbeing of people with CD should be taken into account. This can be done by promoting access to mental health services. Second, educating people about the seriousness of CD and the effects that bullying can play on a person's well being. This can help to prevent those with CD from experiencing bullying and stigma, especially in schools. Third, providing financial support to caregivers of people with CD can also help improve their wellbeing.

One of the major strengths of this study is the wide international range of scope. This allows us to understand more about the psychosocial challenges faced by people who have CD. One of the limitations in this study is that there could be some undiagnosed CD cases. Population-based studies utilizing blood samples (i.e., IgA tissue transglutaminase and IgA endomysial antibodies) estimated the prevalence of CD was approximately 1.0% among non-Hispanic White persons.^{26,27} A multi-center study of over 13,000 patients found the prevalence of CD was higher than those considered at risk (e.g., symptomatic,

first-degree relative, or second-degree relative). The study concluded approximately 97% of individuals with CD were undiagnosed. Thus, the extent of poor mental health associated with CD may be greater than previously thought.²⁸ Other limitations include the predominance of observational and cross-sectional studies that therefore cannot establish causality between poor mental health and the severity of CD. Also, the studies included in this review used different psychological assessment tools to measure mental health outcomes and problematic eating behaviors. This means due to the difference in questions and scoring it may make it difficult to compare the results across the many studies. Another limitation was the variation in the study population, including differences in age, sex, and country, which made it difficult to compare the association between celiac disease and mental health, behavioral, and social outcomes across studies. Publication bias is another potential limitation although this review included several studies that did not find. Lastly, there are a relatively limited number of studies specifically investigating sex-based differences which leaves room for more further research.

In conclusion, CD individuals are more likely to experience poorer mental health outcomes, especially in children, adolescents, young adults, and adults. The most common include anxiety, depression, and problematic eating behaviors. Bullying and discrimination are also common, especially in school settings. There is also evidence that women with CD are found to be more affected than men, specifically anxiety, showing there are gender differences.

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