

## Celiac Disease and Stress: Exploring the Link

Saloni Sharma and Pratibha Singh

### Abstract:

Celiac disease is a chronic autoimmune gastrointestinal condition with a global spread of 0.5 to 1%. It is characterized by inflammation of the small intestine triggered by the consumption of a protein called gluten found in wheat, rye, and barley. Exposure to gluten results in enteropathy, causing damage to the mucosal surface and leading to nutrient malabsorption. Elimination of gluten from the diet is the only effective way to treat celiac disease. Stress, a ubiquitous condition, both the physical and psychological wellness of an individual is affected by stress. An adaptive reaction especially in the gastrointestinal tract and immune system is produced in response to stress, to ensure the survival of an individual. Upon diagnosis and transition to a gluten-free healthier lifestyle, people suffering from celiac disease often experience heightened levels of emotional imbalance and stigmatization. Addressing these aspects is crucial for both medical and psychological communities. This review aims to explore the association between celiac disease and stress, examining how stress influences the physical and psychosocial life of individuals with this condition. Drawing on numerous reputable papers from diverse authors worldwide, the findings suggest a robust link between celiac disease and stress, leading to anxiety, depression, and stigmatization, directly impacting the standard of living for affected individuals. This article will also explore coping strategies for those dealing with both celiac disease and stress.

JK-Practitioner2024;29(2-3):04-14

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**Indexed** : EMBASE, SCOPUS, IndMED, ESBCO, Google Scholar besides other national and international Databases.

**Cite this article as:** Sharma S, Singh P. Celiac Disease and Stress: Exploring the Link. JK Pract 2024;29(2-3):04-14

Full length article available at [jkpractitioner.com](http://jkpractitioner.com)

**Keywords:** Celiac Disease, Stress, Anxiety, Malabsorption, Autoimmune Disease, Gastrointestinal tract, Gut-brain axis, coping strategies, Meditation

### Introduction

Those with chronic illnesses encounter daily obstacles in handling discomforting symptoms. Consequently, individuals with chronic illness are frequently more prone to encountering both physical and psychiatric challenges, leading to a diminished quality of life.[1] Celiac disease affects the body's functioning and may lead to psychiatric symptoms.[2] Celiac disease is an autoimmune condition that has become more prevalent, yet it remains an area of limited research. Celiac disease is associated with various short- and long-term physical symptoms. The main clinical recommendation for individuals with this condition is to avoid consuming gluten. This is aimed at preventing gut inflammation and the subsequent manifestation of symptoms.[3] People with celiac disease often face challenges in managing immediate symptoms, as gluten is a common ingredient in various foods including wheat, rye, and barley.[4] Additionally, despite following a gluten-free diet, numerous

individuals experience unpleasant gastrointestinal symptoms.[2] Beyond the observable physical manifestations, limited exploration is underway concerning the psychological aspects linked to celiac disease. Key psychological symptoms encompass anxiety, depression, irritability, and cognitive challenges stemming from nutritional deficiencies.[5] The impact of such an experience can significantly disrupt the daily physical, emotional, and social functioning of patients. This disruption may cause psychiatric distress, which can create challenges in managing the illness.[6] This review article seeks to deliver a comprehensive examination of the physical and psychological correlations between celiac disease and stress. The emphasis is on elucidating how the coexistence of celiac disease and stress impacts the standard of living for individuals affected by the condition. Additionally, the article explores coping strategies aimed at alleviating the challenges which are associated with managing these concurrent factors.

### 1. Physiological factors in celiac disease

Celiac disease (CD) is unique among autoimmune disorders because of its well-defined genetic factors (HLA-DQ2 and HLA-DQ8), the involvement of tissue transglutaminase (tTG) as an auto-antigen, and the environmental trigger of gluten. Although creating an animal model for CD research has been challenging, recent advancements in technologies in human gut biology and immunology offer promising opportunities for breakthroughs.

Similar to other autoimmune diseases, CD has seen a notable increase, challenging the traditional belief that gluten is the sole determinant of disease onset in genetically susceptible individuals. The rise in autoimmune disorders in developed countries over the past four decades is linked to improved hygiene and reduced exposure to pathogens.[8,9] This suggests that environmental and lifestyle factors like the hygiene hypothesis, may contribute to the rise of autoimmune diseases. Recent breakthroughs in understanding the gut microbiome's influence on immune tolerance and response have led to a re-examination of the hygiene hypothesis.[10]

The causes of autoimmune diseases are still debated, with some suggesting that they result from excessive microorganism exposure while others argue that it's due to insufficient exposure. However, it's widely accepted that the development of these diseases involves adaptive immunity and an imbalance between T helper 1 and 2 cell responses. In addition to genetic predisposition and gluten exposure, The key components of celiac disease autoimmunity encompass the dysfunction of the intestinal barrier, a pro-inflammatory response prompted by gluten, inappropriate immune reactions, and an imbalanced gut microbiome.

#### Gluten indigestion

Gluten, a protein commonly found in our diet, has special properties that make it resistant to digestion. It contains several non-digestible peptides that can trigger immune reactions. The body may become less tolerant to gluten if it is continuously consumed because of its difficulty in digestion. When the immune system is activated, like during a gastrointestinal infection, the risk goes up. Gliadins, which are important parts of gluten, are complex proteins full of proline and glutamine. This makes it hard for intestinal enzymes to fully break them down.[11] As a result, incomplete digestion produces a mixture of peptides that can provoke responses from the host, including increased intestinal permeability and both innate and adaptive immune reactions. These responses closely resemble those induced by exposure to potentially harmful microorganisms.[12-15]

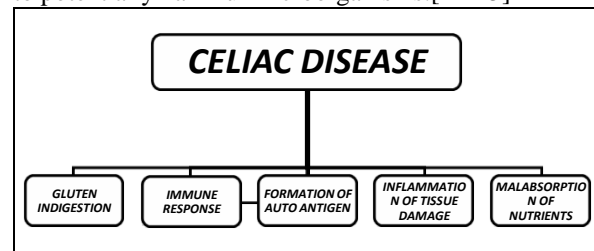


Fig1. Physiological factors in celiac disease

#### Immune response

The most common intestinal illness in Western countries is celiac disease, an autoimmune condition triggered by an abnormal immune response to gluten in food. Individuals who have a genetic predisposition and carry the HLA-DQ2 or -DQ8 haplotype experience a specific reaction. Even though advancements in knowledge, the exact chemical pathways that lead to damage in the mucosal lining of the intestine and the increased influx of gluten peptides into the intestinal mucosa, prompting the inflammatory response, are not yet fully understood.[16] Recent studies suggest the role of various gluten peptides in the disease, with some considered 'toxic,' causing mucosal damage when introduced to duodenal biopsy cultures. On the other hand, HLA-DQ2 or -DQ8-restricted T cell clones from the jejunal mucosa of celiac patients are stimulated by the immunogenic peptides. The two immune pathways that these peptides activate are the innate immune response and the adaptive immune response, which is mediated by CD4+ T cells in the lamina propria.[16]

#### Formation of auto-antigens

Celiac disease involves antibodies targeting transglutaminase 2 (TG2). A particular anti-TG2 antibody (679-14-E06) related to TG2, obtained from the celiac patient with intestinal IgA plasma cells, was

studied. One of the four disease-related epitopes is the target of this antibody.[17] small-angle X-ray scattering and modeling based on crystal structures were used to test TG2 mutants to find and confirm the binding interface. Studies have demonstrated that certain TG2 residues are essential for 679-14-E06 and related antibodies to bind to the same epitope. According to molecular dynamics simulations, the N-terminal domain of TG2 interacts with 679-14-E06 through certain loops in both the heavy and light chains. Through the framework 3 regions of the heavy chain the catalytic domain of TG2 establishes additional connections. These results shed light on the reasons why epitope 1-specific antibodies heavy and light chain gene regions are preferred in celiac disease patients.[17]

#### Inflammation of tissue damage

Histological analysis for diagnosing celiac disease uses Marsh classification, noting increased (intraepithelial lymphocytes) IEL counts and lamina propria cell density. In individuals with celiac disease, light microscopy reveals irregular villi, degenerated enterocytes, and a flat columnar epithelium with disrupted nuclear alignment. [18] Some villi exhibit hyperplasia of Leiburkuhn crypts and inflammation in the lamina propria. Recent studies indicate further mucosal changes including inflammation, reduced villi height, and total mucosal atrophy with severe inflammation and increased crypt depth. Celiac disease is characterized by elevated IELs, goblet cell hyperplasia, vascular abnormalities, and haemorrhage in intervillous spaces.[18]

#### Malabsorption of nutrients

Untreated celiac disease patients experience deterioration of the small intestine villi, focusing on the apical enterocyte brush boundary, which is the site of lactase. This results in a partial lactase enzyme deficiency that causes lactose malabsorption (LM) and lactose intolerance (LI). Studies show that 24% of individuals also are CD who are diagnosed with LI through Hydrogen Breath Testing (HBT), the confirmation of positive serology and biopsy.[19] The various symptoms of LI, such as abdominal pain, bloating, and diarrhoea, can overlap with those of CD[20,21] Both LI and CD exhibit a positive response to dietary changes, and clinicians may sometimes misdiagnose LI, potentially overlooking CD, particularly in paediatric cases.[22-24] After starting a gluten-free diet (GFD) to treat celiac disease (CD) and restore the intestinal lining, many patients regain their ability to tolerate lactose within one to two months.[25] It is suggested to use hydrogen breath testing (HBT) to monitor the healing of the intestinal lining in people with treated CD. However, some CD patients who do not respond to the GFD often experience lactose intolerance (LI). Biopsy results

show a significant deficiency in disaccharides, especially in lactase, in these cases. Nonresponsive celiac disease (NRCD) affects about 20% of celiac patients, with up to 8% of NRCD cases attributed to lactose intolerance.[27]

Malnutrition is mostly caused by CD because it damages the small intestinal villi, which are essential for absorbing nutrients. Paediatric patients may exhibit failure to thrive from chronic malabsorption. In CD the autoimmune inflammatory response increases the permeability of the small intestine, leading to symptoms such as diarrhoea, steatorrhea, weight loss, anaemia, and osteopenia<sup>28</sup>. CD is a significant cause of bone loss, contributing to an elevated risk of fractures in affected individuals. Low absorption of vitamin D and calcium, potentially causing hyperparathyroidism. Compared to healthy individuals, CD patients experience low levels of vitamin D and higher levels of parathyroid.[29-31] 70% of newly diagnosed and untreated celiac disease patients<sup>32</sup> experienced osteoporosis. CD diagnosis includes some minerals and vitamin deficiencies including iron, B12, calcium, vitamin D, zinc, and copper[33,34] While a strict GFD usually resolves symptoms in most CD patients, around 30% may still experience persistent nutritional deficiencies despite dietary compliance [35-38]

#### Genetics link

Celiac disease (CD) exhibits a strong hereditary element, evident in its high familial recurrence and significant harmony among monozygotic twins.[39] The genetic component of CD is mostly determined by the HLA class II heterodimers, specifically DQ2 and DQ8, just like in other autoimmune disorders. Homozygosity for HLA-DQ2 increases the substantial risk of developing CD in infants with an FDR affected by the disease.[40-42] Despite the prevalence of HLA-DQ2/HLA-DQ8 in the general population, only 3% of these individuals develop CD[43] “Genome-wide association studies have identified over 100 non-HLA-related genes associated with CD, although their significance in conferring genetic risk is relatively limited”. However, these genes could provide information about important pathways that could be implicated in the disease's pathophysiology. [44]

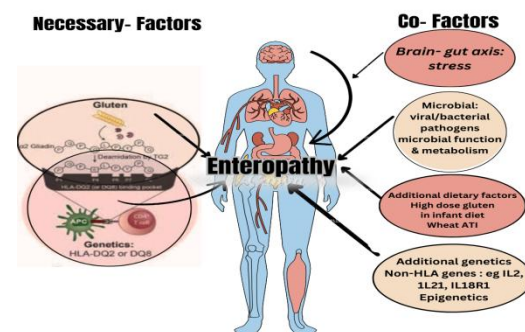


Fig: 2 Represents Enteropathy Causing Factors

**Effect of stress on health**

Stress is a complex concept with varied interpretations in literature, emphasizing the subjective nature of individual perceptions and responses to stressors. Some definitions include stress as a detrimental connection between individuals and their work environment.[45] Others describe it as a combination of behavioural, emotional, and cognitive reactions to perceived obstacles that hinder goals or threaten well-being.[46] Additionally, stress is portrayed as a condition marked by physical, psychological, or social complaints, arising when individuals feel incapable of meeting expectations or requirements.[47] While stress is acknowledged as a factor individuals must navigate[48] it commonly carries a negative connotation, viewed as an undesirable and harmful phenomenon[49]

Stress manifests differently among individuals and is acknowledged as a contributor to both physiological and psychological health issues[50] It can result in various disorders ranging from chronic fatigue to depression.[51] In more severe instances, prolonged stress or traumatic experiences may contribute to psychological issues and pave the way for psychiatric disorders[52] Some people may use unhealthy coping strategies, such as smoking, binge drinking, eating poorly, or not exercising, to deal with stress.[50] As a consequence, they might experience distress, irritability, diminished enjoyment in their work, decreased commitment, and difficulties in logical thinking and decision-making[51,53] Generally, stress is perceived to elicit psychological and/or physiological responses that impact overall health.

**Celiac disease and stress: link**

Certainly, Gluten-related illnesses, like celiac disease and gluten sensitivity or gluten intolerance, are often primarily associated with digestive symptoms, affecting the intestine and stomach. It's crucial to understand, though, that these illnesses may have more serious effects that affect organs other than the digestive system, such as the brain. Two significant links exist between celiac disease and stress, encompassing both physiological and psychological factors that may impact mental health and brain function.

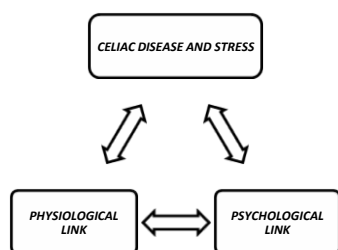


Fig 3. Link: celiac disease and stress

**Physiological Link between Celiac Disease and Stress:**

**Inflammatory Response:** Inflammation is associated with food sensitivity and the presence of emerging glycotoxins, as indicated by recent research.[54]. Some individuals exhibit an immune response to certain foods and dietary proteins, treating them as pathogens or antigens. This reaction can lead to submucosal, epithelial, and mucus elements inflammation and cytokine stress. “The inflammation, primarily composed of cytokines, interleukins (IL)-8, and pro-inflammatory cytokines such as tumour necrosis factor (TNF)- $\alpha$  and interferon (IFN)- $\gamma$ , is believed to be involved in this process. Inflammation has the potential to induce alterations in the expression and/or localization of tight junction proteins, influencing the uptake of drugs by the central nervous system (CNS)”.[55]. Potential targets for pharmacological treatment and design are metabolites within the gut-brain axis[56] Gluten consumption can trigger the autoimmune response in celiac disease individuals and extends beyond intestinal inflammation to affect various organs, including the brain. Neurological symptoms and overall cognitive performance can be affected by chronic inflammation, which is frequently made worse by stress.

**Brain-Gut Axis Interaction:** psychological stress influences and is influenced by digestive health called brain-gut axis, an interpersonal communication between the gut and the brain. Stress may exacerbate gastrointestinal symptoms and contribute to a cycle of distress for individuals with celiac disease[57].

Stress can lead to changes in microbiota composition and affect neurotransmitter and pro-inflammatory cytokine levels, which in turn can impact the microbiota directly or indirectly. For instance, norepinephrine can enhance the virulence of certain bacteria like E. coli or C. jejune. Furthermore, the gut microbiota has been demonstrated to influence pain sensation, and some probiotics have the potential to mitigate hypersensitivity and intestinal permeability induced by stress exposure. Compelling evidence highlights the complex interaction between stress, the immune system, and gut microbiota.[58]

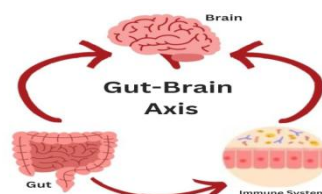


Fig 4: The Intricate Interplay Between Stress, The Immune System, and Gut Microbiota

Exposure to stress can lead to dysregulation of the brain-gut axis, which may contribute to the development of various gastrointestinal disorders.

These disorders include gastroesophageal reflux disease (GERD), peptic ulcer disease (PUD), inflammatory bowel disease (IBD), irritable bowel syndrome (IBS), as well as conditions like food allergies or celiac disease.[59,60]

**Nutrient Absorption Issues:** Malabsorption of nutrients in the small intestine can result from celiac disease. This malabsorption may extend beyond essential nutrients for the body; it can also impact nutrients crucial for optimal brain function. Stress may further aggravate nutrient deficiencies, influencing mental well-being. According to numerous studies, people with celiac disease (CD) usually have deficiencies in pyridoxine (vitamin B6) and folic acid, two nutrients that are crucial for mood and brain health.[61,62] In a prior investigation, these vitamins were administered to coeliac patients, resulting in positive mood outcomes.[63] However, a robust causal link could not be conclusively established because of the small sample size of only 10 patients in that study. In a more recent double trial involving 65 CD participants, the same author found that individuals with long-standing CD who took additional B complex vitamins for a period of six months experienced substantial improvements in overall health[64].

Multiple studies on depression in individuals with celiac disease have indicated that deficiencies in folate, cobalamin and tryptophan, which result from not following a gluten-free diet and difficulty in absorbing nutrients, may play a role in the onset of psychiatric symptoms. However, these findings are not strongly supported by well-defined studies[65] Moreover, vitamin D deficiency has been associated with decreased bone mineral density in individuals who do not follow a gluten-free diet[68] The lack of vitamin D has frequently been connected to mood disorders, regardless of whether they are unipolar or bipolar, as well as poor cognitive performance[69,70] In a recent medical record review, some authors suggested that vitamin D deficiency could be a latent association between celiac disease and mental disorders[71] but further research is needed to enhance our understanding of this relationship.

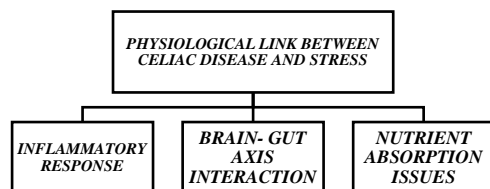


Fig5. Physiological link: celiac disease and stress  
**Psychological Link between Celiac Disease and Stress:**

People who have just been diagnosed with celiac disease face a great deal of psychological challenges

as a result of both the diagnosis and the strict dietary guidelines that must be followed for treatment. Following a gluten-free diet (GFD) means giving up foods that used to be a big part of their lives but are now unfamiliar. There is a possibility that the requirement to adhere to such a diet could set off defense mechanisms, resulting in psychological reactions including denial of the sickness, dread, and anxiety about missing out on foods that one loves. This is consistent with a study from Germany, where it was discovered that celiac disease adhering to a diet free from gluten was strongly linked to feelings of anxiety and sadness<sup>72</sup>. Similarly, studies in Italy.[73] revealed emotions such as rage, fear, and sadness in individuals undergoing treatment for Celiac Disease. The study's analysis of the data demonstrates the critical impact that family support plays in helping people accept their diagnosis and stick to a diet free from gluten, which helps to lessen the psychological effects of having a chronic illness and having to follow dietary restrictions. However, it also underscores the potential for new conflicts within the family environment due to celiac disease (CD), leading to feelings of alienation, rebellion, and sadness.

After a CD diagnosis, individuals often experience social losses. They may feel excluded, lonely, and resentful due to the limited availability of gluten-free dining options. This forces them to constantly adapt to their social interactions. This adjustment can induce guilt and heightened concern in situations that were previously unproblematic before the diagnosis. These results are consistent with research from Italy and Sweden, [74-76] highlighting the societal significance of gluten and the need for comprehensive treatment approaches that address not only serologic and histological control but also psychological aspects to improve the overall health of patients. The study's results echo research in, Australia, Europe, India and the United States, emphasizing the necessity of addressing the bio-psychosocial aspects of CD care. Significantly, this study closes a gap in the Brazilian literature by providing more information about psychological problems and how they affect CD treatment area that hasn't been thoroughly examined previously.

**Strategies for managing and dealing with stress with celiac disease**

Patients who have a chronic illness have a variety of obstacles that call for the creation of coping mechanisms to preserve their emotional health, sense of competence, and positive self-perception. Adopting a diet free from gluten is a major change in the way of living that can be tough to implement and challenging to accept<sup>77</sup>.

Adolescence introduces additional challenges due to peer-group orientation and engagement in risky behaviours. Strict adherence to a GFD demands constant attention, heightened control over food choices, careful monitoring of labels, and limited options in social settings, such as restaurants[78] Challenges with adherence are most pronounced in peer-group environments rather than within the family setting[79].

The term "coping" refers to behaviours aimed at managing stressful situations, influencing adherence to GFD. However, limited research, primarily in adult populations, has explored this connection. Coping involves complex cognitive, behavioral, and emotional responses to stress, with adaptive or maladaptive strategies. Task-oriented coping, seeking solutions, is considered adaptive, while emotional coping, such as aggressive behaviour, is viewed as maladaptive[80]

Research indicates a connection between emotion-focused coping and poor illness adjustment, as well as avoidant coping and non-adherence to treatment [81] This contradicts the belief that a diverse coping repertoire improves the ability to respond effectively to stressors.[82]. Effective coping improves emotional, physical, and social well-being, along with overall quality of life [83] In many areas of life, adolescents who rigorously follow the GFD are similar to their counterparts who do not have chronic illnesses.[84].

Examining psychological factors in treatment adherence emphasizes the importance of including personality traits. Previous research suggests that identifiable personality traits may influence reactions to a celiac disease diagnosis and impact adherence to GFD[85]. For instance, higher conscientiousness in adults, reflecting better organization and planning, correlates with greater adherence to GFD[78]. Surprisingly, there have been no studies exploring personality traits and coping mechanisms in adolescents with celiac disease.

To effectively manage celiac disease, it's essential to fully commit to a gluten-free lifestyle. By collaborating closely with medical professionals and staying updated on the latest advancements in gluten-free living, you can pave the way for a healthier, more enriching, and stress-free life with celiac disease.

#### **Role of meditation to overcome stress living with celiac disease**

One useful strategy for reducing the stress brought on by having celiac disease is meditation. Although more study is required, some people think that meditation is a natural way to control the immune system because it seems to enhance immunological function. The practice offers numerous scientifically backed health benefits and is particularly effective in stress management, requiring only a daily commitment of 20 minutes for noticeable results. A simple mantra-based

meditation involves repeating the word "beeja" in the mind, aiming to quiet other thoughts and foster a connection between the mind and body. This practice helps in being present in the moment, free from concerns about the past or future. The profound restorative effects of meditation promote harmony among the body, mind, and nervous system, allowing for a deep reset and rest. During meditation, the levels of rest and stillness are so profound that the brain undergoes rewiring, leading to a more balanced and adaptive response to challenges. Brain imaging suggests that just three months of meditation can shrink the amygdala (the "stress centre") and increase grey matter, resulting in increased calmness and mental resilience.[86]

For individuals dealing with the stress of chronic conditions like celiac disease, meditation proves beneficial by reducing the easily triggered "fight or flight" response. Stress and the fear of flare-ups are common challenges, making natural stress dissipation through meditation potentially life-changing. Anecdotal evidence suggests that meditation may ease autoimmune disorder symptoms, theorizing that the practice and its subsequent relaxed state soothe an overactive immune response, improving the body's ability to distinguish harmful from non-harmful stimuli [86].

Furthermore, meditation, especially using mantras, helps manage the stress response, potentially reducing the hyperactivity of the immune system. This, in turn, may alleviate symptoms of inflammation and discomfort, presenting meditation as a potential anti-inflammatory exercise.[86]

#### **Conclusion**

In this study, we identified a connection between celiac disease and stress, wherein individuals with this gastrointestinal and autoimmune condition may experience symptoms such as swelling, abdominal and joint pain, headaches, and reduced blood flow to the brain due to the production of antibodies against their tissues. The immune response triggered by celiac disease may lead to the release of stress hormones. Prolonged or intense stress is associated with various psychological and biological changes, including depression, anxiety, hypertension, headaches, and sleep disturbances. Moreover, celiac disease patient has to face additional stressors related to controlling a diet free from gluten, such as challenges in finding suitable options outside the home and the constant threat of cross-contamination. Stress has been linked to the onset of celiac symptoms and can also impact the composition of the gut-micro biome, potentially causing dysbiosis and gastrointestinal symptoms. On a psychological level, stress is closely tied to symptoms like depression and anxiety, and severe and prolonged stress can even lead to diagnosable psychological

disorders. Maladaptive coping strategies, such as substance abuse, can worsen psychological distress and hinder effective illness management, such as sticking to a diet free from gluten.

A strictly followed diet free from gluten may also be connected to higher anxiety, despite the fact that psychological suffering is typically linked to poorer adherence. This may be attributed to the psychological burden of being overly vigilant about one's diet. Although strict adherence is crucial for health, it should not become mentally exhausting. If individuals with celiac disease find themselves regularly stressed,

anxious, or fatigued, it may indicate a need for additional psychological or mental health support. Managing the challenges of celiac disease requires assessing coping strategies and their impact on overall physical and psychological health. Looking for help from a psychologist and counsellor can provide effective, evidence-based strategies for illness management. Developing a personalized combination of stress management techniques is essential for well-being, and individuals should explore various approaches to see which ones suit them the best.

Table1: Strategies to manage and cope-up from stress with celiac disease.

Education and Awareness:	Learn about celiac disease, its symptoms, and potential sources of gluten. This information is essential for making wise decisions on lifestyle and diet.
Consultation with Healthcare Professionals:	Seek guidance from healthcare professionals, including a gastroenterologist and a registered dietician, to confirm the diagnosis and create a personalized management plan.
Diet free from gluten:	Adopt and strictly adhere to a diet free from gluten. Avoid wheat, barley, rye, and their derivatives. Read food labels carefully, and be aware of hidden sources of gluten in processed foods.
Whole Foods:	Focus on naturally gluten-free whole foods such as fruits, vegetables, lean proteins, and gluten-free grains like rice and quinoa. Minimize processed and packaged foods, as they may contain hidden gluten.
Gluten-Free Cooking and Baking:	Experiment with gluten-free recipes and cooking techniques to enjoy a variety of meals. Explore alternative flours like almond, coconut, or rice flour for baking.
Products free from gluten:	Use certified products free from gluten and substitutes for common gluten-containing items, such as bread, pasta, and flour, which are widely available in many grocery stores
Prevention from cross infections:	Take precautions to prevent cross-infections at home and in restaurants. Use separate kitchen equipment. Communicate your dietary needs to restaurant staff to ensure safe food preparation.
Label Reading	Develop the habit of reading food labels to identify potential sources of gluten. Manufacturers often label products as "gluten-free," making it easier to choose safe options.
Support Groups	Join celiac disease support groups, either in-person or online, to connect with others who share similar experiences. Sharing tips, recipes, and emotional support can be invaluable.
Regular Follow-Ups	Schedule regular check-ups with healthcare professionals to monitor your overall health, nutritional status, and adherence to the diet free from gluten. Adjustments to the management plan may be needed over time.
Vitamin and Mineral Supplements:	Consider vitamin and mineral supplements, especially if there are deficiencies due to malabsorption. Before beginning any supplementation, talk with a healthcare provider.
Travel Preparations	Plan ahead when traveling to ensure access to safe and gluten-free food options. Research restaurants, pack gluten-free snacks, and carry a supply of gluten-free staples if needed.

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