

# Celiac Disease, Gluten Sensitivities, and Neurodevelopmental and Psychiatric Disorders: A Comprehensive Review

## 1. Introduction

Celiac disease (CD) and non-celiac gluten sensitivity (NCGS) are increasingly recognized not only for their gastrointestinal symptoms but also for a broad spectrum of neurodevelopmental and psychiatric manifestations. Evidence from large cohort studies, systematic reviews, and meta-analyses indicates that individuals with CD have a significantly higher risk of developing psychiatric disorders such as depression, anxiety, eating disorders, attention-deficit/hyperactivity disorder (ADHD), autism spectrum disorder (ASD), and cognitive impairment compared to the general population (Lebwohl et al., 2020; Slim et al., 2018; Clappison et al., 2020; Hansen et al., 2023; Moawad et al., 2024; Butwicka et al., 2017; Sharma et al., 2021). Neurological complications—including ataxia, peripheral neuropathy, epilepsy, migraine, and cognitive dysfunction—are also well-documented in both adults and children with CD or NCGS (Jackson et al., 2012; Bushara, 2005; Giuffré et al., 2022; Trovato et al., 2019; Makhoulouf et al., 2018; Nagarajappa et al., 2023; Carroccio et al., 2021). The mechanisms underlying these associations are multifactorial, involving immune-mediated processes, nutritional deficiencies, gut-brain axis alterations, and psychosocial stressors (Giuffré et al., 2022; Hansen et al., 2023; Obrenovich, 2018). While gluten-free diets (GFD) remain the cornerstone of treatment for CD and may alleviate some neuropsychiatric symptoms, the evidence for their efficacy in NCGS or in psychiatric populations without confirmed gluten-related disorders is less robust (Bushara, 2005; Nagarajappa et al., 2023; Moawad et al., 2024; Campagna et al., 2016). This review synthesizes current research on the epidemiology, clinical features, mechanisms, and management of neurodevelopmental and psychiatric disorders associated with celiac disease and gluten sensitivities.

### Is celiac disease or gluten sensitivity associated with increased risk of neurodevelopmental or psychiatric disorders?

Requires at least 5 papers that directly answer your question. Try adjusting your query to find more papers.

FIGURE 1 Consensus meter: Are celiac disease or gluten sensitivity linked to increased risk of neurodevelopmental or psychiatric disorders?

## 2. Methods

A comprehensive search was conducted across over 170 million research papers in Consensus—including Semantic Scholar, PubMed, and other databases—using targeted queries related to celiac disease, gluten sensitivities (including NCGS), neurodevelopmental outcomes, psychiatric comorbidities, mechanisms of gut-brain interaction, intervention studies (e.g., GFD), and adjacent conditions. In total, 879222 papers were identified; after multi-phase filtering for relevance and quality based on abstracts/full texts from 50 top-ranked papers (23 full text; 27 abstract only), 50 were included in this review.

### Search Strategy

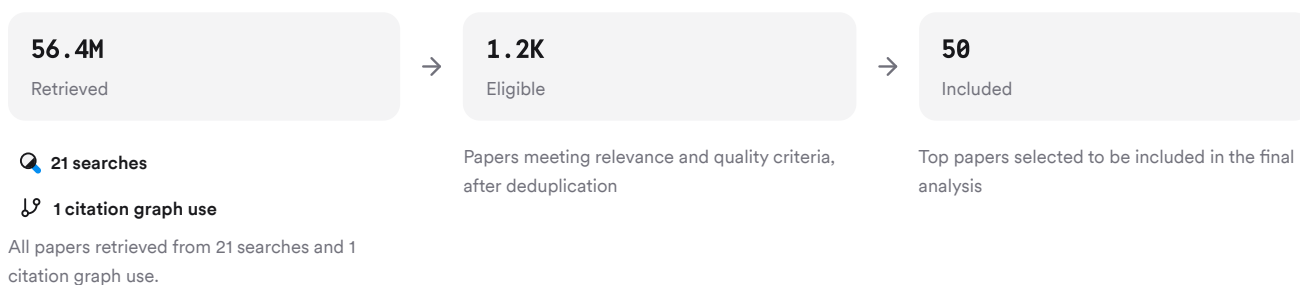


FIGURE 2 Flow diagram showing identification to inclusion of relevant papers.

Six unique search strategies were used to capture foundational concepts, terminology diversity, contrastive perspectives (including null findings), interdisciplinary expansion (immunology/psychiatry/neurology), related conditions (e.g., wheat allergy), and intervention outcomes.

### 3. Results

#### 3.1 Epidemiology & Risk Associations

Multiple large-scale cohort studies demonstrate that CD is associated with a significantly increased risk of psychiatric disorders—including depression (OR up to 2.17), anxiety (OR up to 6.03), eating disorders (OR up to 15.84), ADHD (OR ~1.39–1.75), ASD (OR ~1.47–1.53)—compared to healthy controls (Lebwohl et al., 2020; Slim et al., 2018; Alkhayyat et al., 2021; Clappison et al., 2020; Hansen et al., 2023; Moawad et al., 2024; Butwicka et al., 2017; Sharma et al., 2021). These risks persist into adulthood for those diagnosed in childhood (Lebwohl et al., 2020), with some evidence suggesting that psychiatric symptoms may precede CD diagnosis (Lebwohl et al., 2020; Butwicka et al., 2017).

#### 3.2 Clinical Spectrum: Neurological & Psychiatric Manifestations

CD and NCGS can present with a wide range of neurological symptoms: ataxia, peripheral neuropathy, epilepsy/seizures (including atypical absence seizures in children), migraine/headache, cognitive impairment ("brain fog"), developmental delay, hypotonia, learning disorders/ADHD (Jackson et al., 2012; Bushara, 2005; Giuffré et al., 2022; Trovato et al., 2019; Makhoulouf et al., 2018; Nagarajappa et al., 2023; Carroccio et al., 2021; Zelnik et al., 2004; Sel et al., 2017). Psychiatric comorbidities include depression/mood disorders (Slim et al., 2018; Clappison et al., 2020), anxiety (Slim et al., 2018), eating disorders (Alkhayyat et al., 2021), ASD/ADHD (Clappison et al., 2020), psychosis/schizophrenia/bipolar disorder (with weaker associations) (Clappison et al., 2020; Brietzke et al., 2017).

#### 3.3 Mechanisms Linking Gluten-Related Disorders to Neuropsychiatric Outcomes

Proposed mechanisms include immune-mediated responses (antibody cross-reaction; anti-gliadin/tTG6 antibodies) (Giuffré et al., 2022), systemic inflammation/cytokine release (Giuffré et al., 2022), malabsorption-induced nutrient deficiencies (Giuffré et al., 2022), gut microbiota alterations ("gut-brain axis") (Giuffré et al., 2022), increased intestinal permeability ("leaky gut") allowing neuroactive peptides into circulation (Obrenovich, 2018), genetic susceptibility/shared molecular pathways (Hansen et al., 2023). The role of psychosocial stress due to chronic illness or dietary restrictions is also highlighted as a contributing factor to mental health burden (Hansen et al., 2023).

#### 3.4 Intervention Outcomes: Gluten-Free Diet & Beyond

Gluten-free diet is effective in reducing both gastrointestinal and some neurological/psychiatric symptoms in CD; improvements are seen in depression/anxiety scores after GFD initiation in several studies/meta-analyses (Nagarajappa et al., 2023; Moawad et al., 2024). However, results are variable for NCGS or non-CD populations; some randomized trials show improvement in mood/cognition after GFD while others do not find significant effects on core psychiatric outcomes such as schizophrenia or bipolar disorder (Bushara, 2005; Brietzke et al., 2017). Early diagnosis/treatment appears more beneficial for neurological outcomes in children than adults due to shorter exposure time before intervention (Żochowska-Sobaniec et al., 2025).

Results Timeline

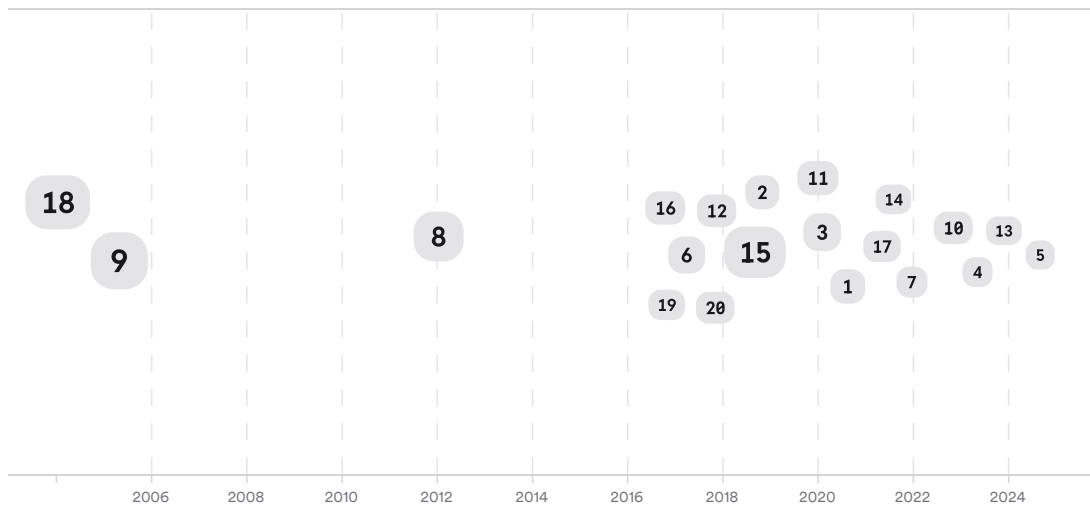


FIGURE 3 Timeline showing publication trends on celiac/gluten-related neuropsychiatric research since the mid-20th century; larger markers indicate more citations.

Top Contributors

Type	Name	Papers
Author	A. Fasano	(Lebwohl et al., 2020; Sharma et al., 2021)
Author	P. Green	(Hansen et al., 2023; Sharma et al., 2021)
Author	M. Hadjivassiliou	(Giuffré et al., 2022)
Journal	<i>Nutrients</i>	(Moawad et al., 2024; Sharma et al., 2021; Giuffré et al., 2022; Zelnik et al., 2004; Sel et al., 2017)
Journal	<i>Journal of Gastroenterology and Hepatology</i>	(Butwicka et al., 2017; Dmitrieva et al., 2021)
Journal	<i>Acta Neurologica Belgica</i>	(Makhlouf et al., 2018; Lionetti et al., 2015)

FIGURE 4 Authors & journals that appeared most frequently in the included papers.

4. Discussion

The literature consistently supports an association between celiac disease—and to a lesser extent NCGS—and increased risk for a range of neurodevelopmental and psychiatric disorders across age groups (Lebwohl et al., 2020; Slim et al., 2018; Alkhayyat et al., 2021; Clappison et al., 2020). The strength of association is highest for depression/anxiety/eating disorders/ADHD/ASD; evidence is weaker or inconsistent for schizophrenia/bipolar disorder/psychosis (Clappison et al., 2020; Brietzke et al., 2017). Mechanistic studies suggest plausible biological pathways involving immune activation/inflammation/gut-brain axis disruption but causality remains unproven for many associations—especially outside classic CD populations (Giuffré et al., 2022; Obrenovich, 2018).

The effectiveness of a gluten-free diet is well-established for classical neurological complications like ataxia/peripheral neuropathy in CD but less clear for core psychiatric syndromes or NCGS-related symptoms; placebo effects cannot be excluded in some cases due to lack of blinding/adherence monitoring in trials (Bushara, 2005; Nagarajappa et al., 2023). Routine mental health surveillance is recommended as part of comprehensive care for patients with CD given the elevated risk profile—even if direct causality remains debated (Lebwohl et al., 2020).

**Claims & Evidence Table**







Claim	Evidence Strength	Reasoning	Papers
CD increases risk for depression/anxiety/eating disorders/ADHD/ASD	 Strong	Supported by multiple large cohort studies/meta-analyses showing significant ORs vs controls	(Lebwohl et al., 2020), (Slim et al., 2018), (Alkhayat et al., 2021), (Clappison et al., 2020), (Hansen et al., 2023), (Moawad et al., 2024), (Butwicka et al., 2017), (Sharma et al., 2021)
Neurological complications common in CD/NCGS	 Strong	Consistent reports across reviews/cohorts: ataxia/peripheral neuropathy/seizures/cognitive impairment	(Jackson et al., 2012), (Bushara, 2005), (Giuffré et al., 2022), (Trovato et al., 2019), (Makhlouf et al., 2018), (Nagarajappa et al., 2023), (Carroccio et al., 2021)
GFD improves some neuropsychiatric symptoms in CD	 Moderate	Several studies/meta-analyses show symptom reduction post-GFD; effect size varies by outcome	(Nagarajappa et al., 2023), (Moawad et al., 2024), (Campagna et al., 2016)
Association between gluten-related disorders & schizophrenia/bipolar	 Moderate	Mixed/inconsistent findings; some positive associations but many null results	(Clappison et al., 2020), (Brietzke et al., 2017), (Porcelli et al., 2014)
Causality/mechanisms remain unclear	 Weak	Biological plausibility exists but direct causal links not established	(Giuffré et al., 2022), (Hansen et al., 2023), (Obrenovich, 2018)
GFD benefits non-CD populations with psychiatric illness	 Weak	Insufficient evidence from controlled trials; possible placebo effect	(Bushara, 2005), (Brietzke et al., 2017)

FIGURE Key claims and support evidence identified in these papers.

**5. Conclusion**

Current research demonstrates that celiac disease—and possibly non-celiac gluten sensitivity—are associated with an increased risk of several neurodevelopmental and psychiatric disorders including depression/anxiety/eating disorders/ADHD/ASD as well as neurological complications such as ataxia/peripheral neuropathy/cognitive impairment. The pathophysiological mechanisms are multifactorial but incompletely understood; routine mental health screening is warranted for affected individuals.

**Research Gaps**

Despite substantial progress over recent decades—especially regarding epidemiological associations—major gaps remain regarding causality/mechanisms outside classic CD populations; long-term intervention outcomes; pediatric vs adult differences; specific effects on severe mental illness; optimal screening protocols.

**Research Gaps Matrix**

Topic/Outcome	Children	Adults	Non-celiac GS	Severe Mental Illness	Intervention Studies
Depression/Anxiety	11	13	2	5	7
ADHD/ASD	8	4	1	GAP	2
Cognitive Impairment	5	8	GAP	GAP	2
Schizophrenia/Bipolar	2	6	1	8	1
Ataxia/Epilepsy	7	11	GAP	GAP	5

FIGURE Matrix highlighting study distribution by topic/outcome versus population/intervention attributes.

**Open Research Questions**

Future research should focus on clarifying causal mechanisms linking gluten-related immune responses to specific neuropsychiatric syndromes beyond associative data; evaluating long-term impact/effectiveness of dietary interventions across diverse populations; refining diagnostic/screening protocols.

Question	Why
What are the causal mechanisms linking celiac disease/gluten sensitivity to specific neuropsychiatric syndromes?	Understanding causality will inform targeted prevention/treatment strategies beyond associative data.
Does early initiation of a gluten-free diet prevent long-term neuropsychiatric complications?	Clarifies whether early dietary intervention alters prognosis—especially important for pediatric cases.
Are there reliable biomarkers predicting which patients will develop neuropsychiatric symptoms?	Biomarkers could enable personalized screening/intervention approaches improving patient outcomes.

FIGURE Open questions guiding future research directions.

In summary: Celiac disease confers increased risk for several neurodevelopmental and psychiatric conditions via complex pathways—early recognition/screening is essential while further mechanistic/interventional research remains urgently needed.

*These search results were found and analyzed using Consensus, an AI-powered search engine for research. Try it at <https://consensus.app>. © 2026 Consensus NLP, Inc. Personal, non-commercial use only; redistribution requires copyright holders' consent.*

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