

UNDERSTANDING CELIAC DISEASE IN INDIA: A BRIEF REVIEW OF ITS POPULATION PREVALENCE, PATHOPHYSIOLOGICAL BASIS AND TREATMENT MODALITIES

RENU CHANE

Associate Professor, Department of Biochemistry, School of Medical Science & Research, Sharda University.

DIVYANSH VASHISHTHA

MBBS Students, School of Medical Science & Research, Sharda University.

DIVESH NASSA

MBBS Students, School of Medical Science & Research, Sharda University.

DIYA

MBBS Students, School of Medical Science & Research, Sharda University.

DIYANSHU RAO

MBBS Students, School of Medical Science & Research, Sharda University.

NIRUPMA GUPTA

Professor, Department of Anatomy, School of Medical Science & Research, Sharda University.

MANOJ KUMAR NANDKEOLIAR*

Professor, Department of Biochemistry, School of Medical Science & Research, Sharda University.
*Corresponding Author Email: drmanojkumar55@gmail.com

Abstract

Background: Celiac disease, a chronic autoimmune disorder triggered by gluten ingestion in genetically susceptible individuals, is increasingly recognised as a significant health concern in India. This review synthesises recent data on the regional variability in prevalence, emphasising the high rates in North India linked to dietary wheat exposure and the genetic predisposition conferred by HLA-DQ2 and HLA-DQ8 alleles. The pathophysiology involves maladaptive immune responses to gluten peptides, which leads to intestinal mucosal injury and systemic manifestations. Management remains centered on lifelong gluten-free diet adherence, which poses unique challenges in the Indian context due to cultural dietary habits, food labelling limitations, and cross-contamination risks. Nutritional counselling, patient education, and public health initiatives are essential for effective disease control. Further research into environmental factors and genotype-phenotype correlations is needed to improve screening and tailored treatment strategies. Addressing these challenges is crucial for mitigating the evolving burden of celiac disease across diverse Indian populations. **Conclusion:** This review aimed to analyse the pathophysiology and prevalence of celiac disease among the Indian population, emphasizing regional variations, genetic predisposition, dietary influences, and diagnostic challenges. Celiac disease represents an emerging public health issue in India, necessitating increased awareness among healthcare professionals and the general population. Standardised diagnostic protocols, population-based screening, and improved accessibility to gluten-free foods are essential for early detection and effective management. Future research should focus on regional epidemiology and the interplay between genetics and dietary habits to inform tailored preventive strategies.

Keywords: Celiac Disease, Indian Population, Pathophysiology, Prevalence, HLA-DQ2/DQ8, Treatment.

INTRODUCTION

Celiac disease is a chronic autoimmune condition caused by the consumption of gluten in individuals who have a genetic susceptibility, and it is becoming an important public health issue in India. Once considered rare outside of European populations, recent studies conducted in communities show that its prevalence varies significantly across India, with the highest rates observed in regions of North India—reaching up to 1.04% of the population, or about one in 96 people. This variation by region aligns closely with differences in wheat consumption as well as genetic susceptibility, particularly the occurrence of HLA-DQ2 and HLA-DQ8 alleles, which play a crucial role in the development of the disease.(1)

Patho physiologically, celiac disease involves a systemic, immune-mediated response to gluten peptides, especially alpha-gliadins. This process disrupts the intestinal epithelial barrier and activates both innate and adaptive immune responses. The resulting inflammation and autoantibody production, particularly against tissue transglutaminase, lead to intestinal villous atrophy and malabsorption syndromes.(2)

Currently, the only confirmed treatment for celiac disease is strict lifelong compliance with a gluten-free diet, which eliminates all sources of wheat, rye, and barley. In India, managing the condition poses distinct challenges, such as local dietary practices, the risk of cross-contamination during milling, and the necessity for continuous nutritional support and education. As awareness and diagnosis rates rise, a thorough review of prevalence, immunopathology, and practical treatment approaches becomes essential for tackling the growing impact of celiac disease India.(3)

India-Specific Prevalence

In India, coeliac disease, a chronic autoimmune condition brought on by gluten consumption in genetically predisposed people, is becoming a serious public health issue. (4) Once thought to be rare outside of European populations, new community-based research shows that its incidence varies widely throughout India, with North Indian regions having the highest rates—up to 1.04% of the population, or roughly one in 96 people. The frequency of HLA-DQ2 and HLA-DQ8 alleles, which are essential to the pathophysiology of disease, and variations in wheat consumption and genetic predisposition are closely reflected in this regional variance.

Recent India-specific prevalence studies show significant variation in coeliac disease rates among areas and populations. The landmark community-based study from the National Capital Region (Delhi) discovered an overall prevalence of 1.04% (1 in 96) in North India using serological and biopsy confirmation. (5) Another population-based study involving over 23,000 healthy adults found age-adjusted prevalences of 1.23% in northern, 0.87% in northeastern, and only 0.10% in southern India, indicating a significant North-South gradient associated to dietary wheat consumption and genetic markers. (6) The seroprevalence among healthy schoolchildren in Chandigarh reached one in 120. (7) These findings indicate that 5-8 million Indians may be affected by coeliac disease, however, the vast majority remain misdiagnosed, with diagnosis rates as low as 3-5%.

According to the most recent worldwide meta-analyses, India is one of the countries with the highest coeliac disease prevalence rates.

Pathophysiology

Coeliac illness is characterised by a systemic, immune-mediated response to gluten peptides, notably alpha-gliadins, that disrupts the intestinal epithelial barrier and activates both innate and adaptive immunity. The resulting inflammation and the generation of autoantibodies, particularly against tissue transglutaminase, lead to intestinal villous atrophy and malabsorption syndromes.

The pathophysiology of coeliac disease in India is similar to global patterns, but is impacted by localised genetic and environmental variables. Coeliac disease in India is caused by dietary gluten (found in wheat, barley, and rye) in genetically vulnerable people, most typically those with the HLA-DQ2 and HLA-DQ8 haplotypes. Gluten peptides are not properly digested in the gastrointestinal tract after consumption. These partially digested peptides pass through the intestinal epithelium and are deamidated by tissue transglutaminase (tTG), boosting their affinity for HLA-DQ2/DQ8 on antigen-presenting cells. (8) This mechanism activates gluten-specific CD4+ T cells in the lamina propria, which generate pro-inflammatory cytokines such as interferon-gamma and interleukin-15. As a result, the small intestine experiences inflammation, villous atrophy, and crypt hyperplasia. The development of antibodies to tTG and endomysial antigens is an example of an autoimmune process.

In India, the high prevalence of HLA risk alleles, particularly in the north, contributes to susceptibility. Additional regional contributors include frequent, early, and high wheat-based food consumption, probable changes in gut microbial compositions, and environmental co-factors such as frequent gastrointestinal illnesses. The clinical range is extensive, spanning from traditional gastrointestinal symptoms (diarrhoea, malabsorption, failure to thrive) to extra-intestinal characteristics (anaemia, short stature, neurological problems), with a significant minority presenting abnormally or remaining silent, delaying prompt identification. (9)

Genetic Markers HLA-DQ2/DQ8

In India, genetic markers play an important role in the aetiology of coeliac disease, with almost all diagnosed individuals expressing either the HLA-DQ2 or HLA-DQ8 variant. (10) In North Indian communities, HLA-DQ2 prevalence is believed to be around 32%, whereas in South India, it ranges from 9% to 23%, with a greater proportion of HLA-DQ8. (11) Studies have shown that the existence of these alleles is necessary but not sufficient for disease development, as up to 30% of the general population possesses the risk alleles without exhibiting symptoms. Notably, North Indian coeliac patients have substantial linkage disequilibrium among the DR3-DQ2 haplotypes, however there is significant variety compared to Caucasian groups. (12, 13) Furthermore, HLA-DQ2 (DQA10501 and DQB10201) and DQ8 (DQA10301 and DQB10302) are strongly linked to higher serological positivity and severity of intestinal mucosal injury in Indian cohorts.

The absence of these HLA haplotypes has a strong negative predictive value for coeliac disease, making HLA genotyping an important risk stratification and population screening technique in India. (14)

The genetic propensity to coeliac disease in India is closely connected to the HLA-DQ2 and HLA-DQ8 alleles, with nearly all patients carrying one or both. In North India, the frequency of HLA-DQ2 can reach 32%, compared to 9-23% in the South, whereas HLA-DQ8 is more common in South Indian people. Although the existence of these alleles is thought to be necessary for disease development, only a small proportion of people who possess the risk alleles acquire coeliac disease, indicating the involvement of other genetic and environmental variables. Genotyping investigations in North Indian coeliac cohorts revealed significant linkage disequilibrium across DR3-DQ2 haplotypes, with patterns that differed from those observed in Western populations. (15) In addition, HLA-DQ2 (DQA10501, DQB10201) and DQ8 (DQA10301, DQB10302) are related with higher serological positive for coeliac disease markers and more severe mucosal injury in Indian patients. In clinical evaluations, the absence of both DQ2 and DQ8 has a significant negative predictive value for coeliac disease.(16)

Allele Frequencies for HLA-DQ2 and DQ8 in North Vs South India

The frequency of coeliac disease-associated alleles varies significantly across India. In North India, the prevalence of the HLA-DQ2 allele ranges from 16% to 32%, whereas the frequency of HLA-DQ8 is lower, ranging from 0% to 5%. In contrast, in South India, the prevalence of HLA-DQ2 is much lower—reported at 9-23% depending on subpopulations—while HLA-DQ8 is more frequent, accounting for 19-23% of the population. This variation in genetic risk is assumed to reflect long-standing eating habits and migration histories in different areas. (17) These studies compare quantitative allele frequencies for HLA-DQ2 and DQ8 in north and south India.

Treatment

Currently, the only proven treatment for coeliac disease is a rigorous gluten-free diet that excludes all wheat, rye, and barley products. Management in India poses particular issues, such as eating preferences, the potential of cross-contamination during milling, and the necessity for continual nutritional support and education. (18) As awareness and diagnosis rates improve, a comprehensive evaluation of prevalence, immunopathology, and practical management offers the foundation for tackling the rising burden of coeliac disease in India.(19) (20)

The primary therapy for coeliac disease in India is rigorous, lifelong adherence to a gluten-free diet that excludes all sources of wheat, rye, and barley. Most patients benefit from this dietary regimen, which promotes mucosal repair, symptom relief, and the prevention of problems. However, specific obstacles arise in India due to the prevalence of wheat-based foods, cultural dietary patterns, cross-contamination hazards, and a scarcity of certified gluten-free items. (21)

Dietary advice is essential and should be offered by dietitians who are aware with Indian regional cuisines and food labelling procedures. Patients must be educated on gluten's hidden origins and safe alternatives, which include rice, maize, millets, ragi, jowar, bajra, and gluten-free packaged meals. (22) Regular follow-up and monitoring are recommended to check nutritional status, symptom control, and adherence to the gluten-free diet. In situations of refractory coeliac disease or persistent symptoms despite dietary compliance, examination for comorbid illnesses and adjunct therapy, such as corticosteroids, immunosuppressants, or nutritional supplementation (iron, vitamin D, calcium, folic acid, B12), may be required.(23)

Recent studies emphasise the need for public health initiatives—improved knowledge, standardised labelling, required gluten content declarations in packaged foods, and local advocacy groups—to help patients navigate daily management.(24)

DISCUSSION

The current study is on the complex interplay of genetic, environmental, and culturally factors that influence coeliac disease prevalence, clinical manifestation, and management in India. The large regional variation in prevalence, with North India having the highest rates due to increased wheat consumption and higher frequencies of HLA-DQ2 alleles, emphasises the importance of both dietary habits and genetic risk in disease pathogenesis.

The broad clinical range, which includes atypical and silent presentations, as well as a significant proportion of undetected cases, highlights the need for increased vigilance and extended screening, particularly in groups with high genetic vulnerability.

From a pathophysiological standpoint, the central involvement of HLA-DQ2 and DQ8 alleles in antigen presentation—facilitating a maladaptive immune response against deamidated gluten peptides—reflects global patterns, yet allele frequencies differ significantly between North and South India.

These findings support the use of HLA genotyping for risk stratification and screening in equivocal cases, even while the presence of risk alleles alone is not predictive of disease onset. Environmental factors, such as early and frequent wheat intake and potential differences in gut flora, are important paths for future research in identifying illness triggers in the Indian context.(25)

The treatment situation in India presents unique obstacles. Culinary traditions, product labelling loopholes, and cross-contamination hazards during storage and processing all make it difficult to stick to a gluten-free diet for the rest of one's life. Comprehensive nutritional advising, including individualised recommendations that are appropriate for regional eating habits, is thus essential. Monitoring and supplementing measures for nutritional deficiencies (iron, calcium, and vitamins) remain critical, particularly in children and adults at risk of malabsorption. Continuous attempts to improve food labelling regulations and form patient advocacy/support groups are vital for empowering affected individuals and families. (25)

CONCLUSION

Coeliac disease is being recognised as a serious public health issue in India, with regional prevalence determined by a combination of genetic (HLA-DQ2/DQ8) and dietary variables. Despite advances in prevalence studies and pathogenesis research, widespread underdiagnosis and the complexities of gluten-free dietary management continue to impede optimal outcomes. To address the rising burden, several methods are required, including awareness campaigns, professional education, enhanced diagnostic techniques, and legislative improvements in food labelling. Continued study into environmental co-factors and novel therapeutic techniques could improve risk prediction and management, ensuring comprehensive care for the diverse Indian community impacted by coeliac disease.

Prospects for the Study of Celiac Disease in India are Promising and Multifaceted:

First, extending large-scale epidemiological studies across varied Indian regions will improve prevalence estimates, allowing for focused screening in genetically at-risk populations. Advances in HLA genotyping and integration with next-generation sequencing may reveal further genetic predispositions and gene-environment interactions specific to Indian ethnicity. Longitudinal cohort studies could reveal environmental factors such as gut microbiome changes and early childhood nutritional exposures that influence illness onset.

On the therapeutic front, creating affordable, culturally relevant gluten-free dietary resources and approved food labelling standards will significantly improve management adherence. Novel therapy approaches, such as enzyme treatments, immunotherapies, or microbiome modification, have the potential to supplement or replace stringent gluten avoidance and warrant clinical testing in Indian populations.

Public health activities centred on awareness, early detection, and patient education will be crucial, aided by digital health technologies for illness monitoring and nutritional guidance. Finally, interdisciplinary collaboration among physicians, geneticists, dietitians, and policymakers will be required to turn growing scientific discoveries into practical methods for closing diagnostic gaps and improving patient quality of life. Addressing these future directions can assist to reduce the growing incidence of coeliac disease in India's diverse population.

References

- 1) Lal SB, Venkatesh V, Aneja A, Seetharaman K, Kumar Y, Prasad KK, et al. Clinical spectrum & changing presentation of celiac disease in Indian children. Indian Journal of Medical Research [Internet]. 2023 Jul 1 [cited 2025 Apr 28]; 158(7):75–84. Available from: <https://pubmed.ncbi.nlm.nih.gov/37602589/>
- 2) Celiac Disease (Sprue): Background, Pathophysiology, Etiology [Internet]. [Cited 2025 Oct 30]. Available from: <https://emedicine.medscape.com/article/171805-overview?form=fpf>
- 3) Treatment for Celiac Disease - NIDDK [Internet]. [Cited 2025 Oct 30]. Available from: <https://www.niddk.nih.gov/health-information/digestive-diseases/celiac-disease/treatment>

- 4) Makharia GK, Verma AK, Amarchand R, Bhatnagar S, Das P, Goswami A, et al. Prevalence of celiac disease in the northern part of India: a community-based study. *J Gastroenterol Hepatol* [Internet]. 2011 [cited 2025 Oct 30]; 26(5):894–900. Available from: <https://pubmed.ncbi.nlm.nih.gov/21182543/>
- 5) Makharia GK, Verma AK, Amarchand R, Bhatnagar S, Das P, Goswami A, et al. Prevalence of celiac disease in the northern part of India: A community-based study. *Journal of Gastroenterology and Hepatology (Australia)* [Internet]. 2011 May 1 [cited 2025 Oct 30]; 26(5):894–900. Available from: [/doi/pdf/10.1111/j.1440-1746.2010.06606.x](https://doi.org/10.1111/j.1440-1746.2010.06606.x)
- 6) Ramakrishna BS, Makharia GK, Chetri K, Dutta S, Mathur P, Ahuja V, et al. Prevalence of Adult Celiac Disease in India: Regional Variations and Associations. *Am J Gastroenterol* [Internet]. 2016 Jan 1 [cited 2025 Oct 30]; 111(1):115–23. Available from: <https://pubmed.ncbi.nlm.nih.gov/26729543/>
- 7) Lal SB, Venkatesh V, Aneja A, Seetharaman K, Kumar Y, Prasad KK, et al. Clinical spectrum & changing presentation of celiac disease in Indian children. *Indian J Med Res* [Internet]. 2023 Jul 1 [cited 2025 Oct 30]; 158(1):75. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC10550060/>
- 8) Gupta R, Reddy DN, Makharia GK, Sood A, Ramakrishna BS, Yachha SK, et al. Indian task force for celiac disease: Current status. *World Journal of Gastroenterology: WJG* [Internet]. 2009 Dec 28 [cited 2025 Nov 2]; 15(48):6028. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC2797658/>
- 9) Verma AK, Mechenro J, Monachesi C, Venugopal G, Catassi GN, Lionetti E, et al. Distribution of celiac disease predisposing genes HLA-DQ2 and HLA-DQ8 in the native population of southern India. *Indian J Gastroenterol* [Internet]. 2022 Jun 1 [cited 2025 Nov 2]; 41(3):240–6. Available from: <https://pubmed.ncbi.nlm.nih.gov/35767211/>
- 10) Gaba K, Malhotra P, Kumar A, Suneja P, Dang AS. Understanding the Genetic Basis of Celiac Disease: A Comprehensive Review. *Cell Biochem Biophys* [Internet]. 2024 Sep 1 [cited 2025 Oct 30]; 82(3):1797–808. Available from: <https://pubmed.ncbi.nlm.nih.gov/38907939/>
- 11) Verma AK, Mechenro J, Monachesi C, Venugopal G, Catassi GN, Lionetti E, et al. Distribution of celiac disease predisposing genes HLA-DQ2 and HLA-DQ8 in the native population of southern India. *Indian Journal of Gastroenterology* 2022 41:3 [Internet]. 2022 Jun 29 [cited 2025 Oct 30]; 41(3):240–6. Available from: <https://link.springer.com/article/10.1007/s12664-022-01251-6>
- 12) Lomash A, Singh R, Kumar P, Batra V, Dubey A, Puri A, et al. Utility of human leukocyte antigen DQ2 and DQ8 genotypes in Celiac disease: Two sides of the coin. *Med Res Arch* [Internet]. 2023 Jan 31 [cited 2025 Oct 30]; 11(1). Available from: <https://esmed.org/MRA/mra/article/view/2864>
- 13) Mäki M, Mustalahti K, Kokkonen J, Kulmala P, Haapalahti M, Karttunen T, et al. Prevalence of Celiac disease among children in Finland. *N Engl J Med* [Internet]. 2003 Jun 19 [cited 2025 Nov 2]; 348(25):2517–24. Available from: <https://pubmed.ncbi.nlm.nih.gov/12815137/>
- 14) Bdair BWH, Algraittee SJR. HLA-DQ2 And HLA-DQ8 Haplotypes Influence Circulating Levels of Anti-Tissue Transglutaminase and Anti-Gliadin Antibodies in Celiac Disease: A Review. *Karbala Journal of Pharmaceutical Sciences*. 2025 Jun 30; 16(26):36–47.
- 15) Freeman HJ. Risk factors in familial forms of celiac disease. *World Journal of Gastroenterology: WJG* [Internet]. 2010 [cited 2025 Nov 2]; 16(15):1828. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC2856821/>
- 16) Sarno M, Discepolo V, Troncone R, Auricchio R. Risk factors for celiac disease. *Ital J Pediatr* [Internet]. 2015 Aug 14 [cited 2025 Nov 2]; 41(1):57. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC4535670/>
- 17) Pareek S, Gupta RK, Sharma A, Gulati S. Human Leukocyte Antigen-DQ Genotyping in Pediatric Celiac Disease. *Pediatr Gastroenterol Hepatol Nutr* [Internet]. 2023 [cited 2025 Nov 2]; 26(1):50. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9911170/>

- 18) Deora NS, Deswal A, Dwivedi M, Mishra HN. PREVALENCE OF COELIAC DISEASE IN INDIA: A MINI REVIEW. International Journal of Latest Research in Science and Technology ISSN [Internet]. 2014 [cited 2025 Nov 2]; 3(1):58–60. Available from: <https://www.mnkjournals.com/journal/ijlrst/index.php>
- 19) Gupta R, Reddy DN, Makharia GK, Sood A, Ramakrishna BS, Yachha SK, et al. Indian task force for celiac disease: Current status. World Journal of Gastroenterology: WJG [Internet]. 2009 Dec 28 [cited 2025 Oct 30]; 15(48):6028. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC2797658/>
- 20) Adherence on Gluten Free Diet: Challenges in India | Request PDF [Internet]. [Cited 2025 Nov 2]. Available from: https://www.researchgate.net/publication/299077614_Adherence_on_Gluten_Free_Diet_Challenges_in_India
- 21) Gujral N, Freeman HJ, Thomson ABR. Celiac disease: Prevalence, diagnosis, pathogenesis and treatment. World Journal of Gastroenterology: WJG [Internet]. 2012 Nov 14 [cited 2025 Nov 2]; 18(42):6036. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC3496881/>
- 22) Celiac Society [Internet]. [Cited 2025 Nov 2]. Available from: <https://celiacsocietyofindia.com/>
- 23) Rahimi S, Mahmoudi Ghehsareh M, Asri N, Azizmohammad Loocha M, Jahani-Sherafat S, Ciacci C, et al. Gluten-free diet adherence patterns and health outcomes in celiac disease: a retrospective observational study. BMC Gastroenterol [Internet]. 2025 Dec 1 [cited 2025 Nov 2]; 25(1):591. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC12359905/>
- 24) Mehtab W, Sachdev V, Singh A, Agarwal S, Singh N, Malik R, et al. Gluten content in labeled and unlabeled gluten-free food products used by patients with celiac disease. Eur J Clin Nutr [Internet]. 2021 Aug 1 [cited 2025 Nov 2]; 75(8):1245–53. Available from: <https://pubmed.ncbi.nlm.nih.gov/33462461/>
- 25) Eapen CE, Nightingale P, Hubscher SG, Lane PJ, Plant T, Velissaris D, et al. Celiac disease: can we avert the impending epidemic in India? Indian J Med Res [Internet]. 2025 Jun 1 [cited 2025 Nov 2]; 133(1):5–8. Available from: <http://ijmr.org.in/celiac-disease-can-we-avert-the-impending-epidemic-in-india/>