

## Seroprevalence of Celiac Disease in Tribal Population of High Altitude Area in Northern India

Brij Sharma<sup>1</sup>, Neetu Sharma<sup>2</sup>, Vishal Bodh<sup>1</sup>, Ashish Chauhan<sup>1</sup>, Rajesh Sharma<sup>1</sup>, Alka Singh<sup>4</sup>, Sidhant Sharma, Amit Sachdeva<sup>3</sup>

<sup>1</sup>Department of Gastroenterology, <sup>2</sup>Department of Physiology, <sup>3</sup>Department of Community Medicine, IGMC, Shimla, India. <sup>4</sup>Department of Gastroenterology & Human Nutrition Unit, AIIMS, New Delhi, India.

**Corresponding Author:** Dr. Amit Sachdeva  
Email: dramitsachdeva2410@gmail.com

### ABSTRACT

**Background:** While celiac disease (CeD) is known to occur in many regions on the plains, there is a lack of data on its prevalence in high altitude area of India.

**Methods:** We screened serum samples of 332 participants in Lahaul and Spiti district of (mean altitude >4000 meter) Himachal Pradesh, for the estimation of prevalence of CeD in high altitude area. The screening of CeD was done using commercially available IgA human anti-tissue transglutaminase antibody (anti-tTG Ab) ELISA kit.

**Results:** Of 332 samples (mean age 31.5±15.9 years) screened, two were found to have a positive anti-tTG Ab at low titre, suggesting a seroprevalence of 0.6%.

**Conclusions:** The seroprevalence of CeD in high altitude area is 0.6%, almost equal to the rest of the country. The physicians working in high altitude areas need to be aware about CeD in their communities.

**KEYWORDS:** Celiac disease, High altitude, Prevalence, Anti-tissue transglutaminase.

### Introduction

Celiac disease (CeD) is a disease of public health importance. It is estimated that it affects 40-60 million and 6-8 million, global population and Indian population, respectively.<sup>1,2</sup> Of such a large pool of patients, majority of them remain undiagnosed mainly because of poor awareness about this disease amongst the health-care professionals and the general public. CeD is reported from many parts of India, including Punjab, Haryana,

Delhi, Uttar Pradesh, Bihar, and Maharashtra. While there is a single report from Himachal Pradesh, where Negi et.al reported a series of 25 patients with CeD on screening of 200 suspected patients, however, there is a lack of data on the community prevalence of CeD in the high altitude areas in India.<sup>3</sup> We therefore, utilized the resource of another study conducted for the estimation of prevalence of Hepatitis B Virus (HBV) infection in Lahaul and Spiti district of Himachal Pradesh, to estimate the prevalence of CeD in high-altitude area of India. This

original study was conducted in Lahaul and Spiti district (mean altitude > 4000 meter) of Himachal Pradesh in 2015-16 to estimate the prevalence of HBV infection among residents of hilly tribal district.<sup>4,5</sup> These districts lie into the Trans-Himalayan zone in the northern and north-eastern part of Himachal Pradesh and make a boundary line between Himachal Pradesh, Jammu & Kashmir and Tibet (China) (North latitude: 31° 44' 57" and 32° 59' 57" and between East longitude 76° 46' 29" and 78° 41' 34'). The population in this region consume all kinds of food including rice or wheat.

### Material & Methods

The methods including subject recruitment, sample selection and other related details have been published earlier.<sup>6</sup> The ethical approval for the study was obtained from Indira Gandhi Medical College, Shimla, Himachal Pradesh vide letter No: HFW(MS) G-5 (Ethics)/2014-5257 dated 26/05/2015.

The participants of the study included apparently healthy children/adults aged 3-70 years and they were randomly selected from 35 villages in the district through organization of camps. Study subjects were randomly selected in each village and a total of 1110 subjects residing in Lahaul and Spiti district participated in the study. Data was collected using interview schedule and serum samples were taken and subjected to ELISA for the detection of HBsAg and positive samples were tested thereafter for HBeAg.

After the completion of the data collection phase, the serum samples were carefully processed, labeled, and stored at -20°C after completion of the above mentioned study. This step ensured the preservation of the samples' integrity for subsequent laboratory testing. We could retrieve a total of 332 of 1110 sera for the present study. Following the sample storage phase, the collected serum samples were transported to AIIMS, New Delhi. Given the geographical distance between the study site and AIIMS, New Delhi, during this transportation process, we followed a well-organized logistics plan, including the use of a cold chain to maintain the samples at the required temperature of -70°C.

Upon arrival at AIIMS, New Delhi, the serum samples underwent laboratory testing for the presence of

celiac disease (CeD) autoimmunity using commercially available IgA human anti-tissue transglutaminase antibody (anti-tTG Ab) ELISA (Quanta Lite h-tTG IgA; Inova diagnostics, San Diego, USA). The whole process of sample transportation, testing and analysis took 7-8 months. The range of quantitation of assay was considered as follows; 0-4 U/ml as negative, 4-10 U/ml as weak positive and >10U/ml as positive.<sup>7</sup> Both positive and negative controls were run with each ELISA experiment. Tests were run as per manufacturer's instruction.

### Results

This study involved 332 participants with a mean age of 31.5±15.9 years. **Table 1** shows specific population's

**Table 1: Demographic features of included participants.**

| Variables                  |                                 | Frequency       | Percent |
|----------------------------|---------------------------------|-----------------|---------|
| Gender                     | Male                            | 108             | 32.5    |
|                            | Female                          | 224             | 67.5    |
| Religion                   | Hindu                           | 4               | 1.2     |
|                            | Buddhist                        | 328             | 98.8    |
| Caste                      | Schedule caste                  | 2               | 0.6     |
|                            | Schedule tribe                  | 328             | 98.8    |
|                            | General                         | 2               | 0.6     |
| Educational qualifications | Illiterate                      | 50              | 15.1    |
|                            | Primary                         | 76              | 22.9    |
|                            | Middle                          | 86              | 25.9    |
|                            | High School                     | 52              | 15.7    |
|                            | Higher secondary                | 50              | 15.1    |
| Occupational Status        | Graduate & above                | 18              | 5.4     |
|                            | Clerical/Sales                  | 2               | 0.6     |
|                            | Service                         | 2               | 0.6     |
|                            | Shopkeeper/Business             | 28              | 8.4     |
|                            | Skilled/unskilled manual worker | 4               | 1.2     |
|                            | Agriculture worker              | 88              | 26.5    |
|                            | Domestic worker                 | 24              | 7.2     |
|                            | Unemployed                      | 94              | 28.3    |
| Student                    | 48                              | 14.5            |         |
| Housewife                  | 32                              | 9.6             |         |
| Total                      |                                 | 332             |         |
| Mean age                   |                                 | 31.5±15.9 years |         |

demographic and socioeconomic characteristics. Gender distribution showed 32.5% males (108 individuals) and 67.5% females (224 individuals). Religious affiliation revealed a predominant Buddhist majority (98.8%) and a small Hindu minority (1.2%). In terms of caste, 98.8% identified as Schedule Tribe, with negligible representation in Schedule Caste and General categories. Education levels varied, with 15.1% illiterate, 22.9% having primary education, 25.9% with middle school education, 15.7% at the high school level, 15.1% in higher secondary, and 5.4% holding graduate or higher degrees. Occupationally, there was diversity, including 8.4% participants in shopkeeping/business, 26.5% in agriculture, 7.2% as domestic workers, 28.3% unemployed, 14.5% students, and 9.6% as housewives (Table 1).

Only two individuals exhibited weakly positive anti-tTG antibody levels, measuring 4.79 and 4.704 U/ml, respectively. This finding suggested a prevalence of 0.6% for weak positive anti-tTG antibodies in the sampled population. (Figure 1)

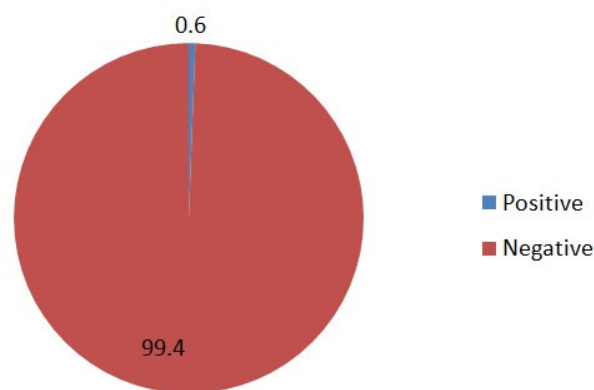
Both of these individuals were contacted and requested to visit Indira Gandhi Medical College in Shimla for a second ELISA test, aimed at confirming the weak positivity. However, they were unable to make the trip due to the challenging terrain and the considerable distance from their hometowns. Since the study was done primarily for HBV infection, neither the symptoms related with CeD were recorded, nor the two seropositive person for anti-tTG Ab could undergo endoscopic examination.

## Discussion

Celiac disease (CeD) is a globally recognized autoimmune disorder with varying prevalence rates in different populations. While several studies have explored the prevalence of CeD in various parts of India, there has been a notable lack of data from high-altitude areas. This study aimed to fill that gap by assessing the seroprevalence of CeD in the Lahaul and Spiti districts of Himachal Pradesh, located at an altitude exceeding 4000 meters.

We observed a seroprevalence of 0.6% in the asymptomatic population in the high mountainous region of India, which is almost similar to the prevalence of CeD in other regions of India, as shown by the Pan-India

## anti-tTG antibody levels



**Figure 1: Distribution of Participants according to anti-tTG antibody levels.**

prevalence study.<sup>2</sup> Another study from Shandong province of northern China including 19,778 adolescents and young adults (16-25Y) also showed a seroprevalence of 0.76%<sup>8</sup> establishing a historical link and geographical proximity between our study population and the Chinese population groups like other studies.<sup>9</sup> These findings highlight not only regional consistency but also suggest that CeD may not exhibit substantial geographical variation within this broader Asian context. Thus, this prevalence is comparable to the rates found in other regions of India and in the study from northern China, indicating consistency in CeD prevalence across different populations. However, it's important to note that this study primarily focused on Hepatitis B Virus (HBV) infection, and individuals with CeD-related symptoms were not specifically identified. Moreover, the challenging terrain and distance hindered further confirmatory testing and endoscopic examination for the two seropositive individuals. Nevertheless, this study underscores the need for healthcare professionals in high-altitude areas to be aware of CeD within their communities and highlights the importance of broader awareness campaigns to improve early diagnosis and management of this significant public health concern.

The major limitation is inclusion of a small sample size and non-availability of clinical details and further testing for confirmation of the diagnosis. We suggest that we do a larger community population-based study from high altitude areas of India.

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## Conclusion

In conclusion, this study conducted in the high-altitude region of Lahaul and Spiti districts in Himachal Pradesh, India, revealed a seroprevalence of Celiac disease (CeD) at 0.6% among the sampled population, as determined by weakly positive anti-tissue transglutaminase antibody levels.

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