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Frequency of Celiac Disease Among Children with Type I Diabetes Mellitus

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ABSTRACT

Background: Celiac disease is common autoimmune problem seen in children having type I diabetes mellitus, but many cases remain undiagnosed due to mild or no symptoms. **Objective:** To determine frequency of celiac disease among children with type I diabetes mellitus. **Study Design:** Cross sectional study. **Duration and Place of Study:** Study was done from 10th July 2024 to 10th January 2025 in department of paediatrics, Lady Reading Hospital Peshawar. **Methodology:** Total 105 children aged 2–13 years with type I diabetes mellitus were included. Patients were assessed for symptoms of celiac disease and biopsy from duodenum was taken for confirmation. Data was analysed using SPSS version 26. Mean and standard deviation were calculated for numerical variables, while frequencies and percentages for categorical variables. Stratification was done and Chi square test was applied. **Results:** Mean age was 7.53±3.24 years. Females were 57 (54.3%) and males were 48 (45.7%). Celiac disease was found in 40 (38.1%) children while 65 (61.9%) had no disease. Significant association was seen with socioeconomic status (p<0.001), residence (p<0.001) and family history (p=0.042). No significant association was seen with age (p=0.863), gender (p=0.489), weight (p=0.329) and duration of diabetes (p=0.301). **Conclusion:** Celiac disease is frequent in children with type I diabetes mellitus and linked with some demographic factors

INTRODUCTION

Diabetes mellitus among children is a chronic disease characterized by autoimmune destruction of the beta cells in the pancreas leading to a complete lack of insulin production.[1] The condition develops in childhood or adolescence and is typified by symptoms such as excessive urination, thirst, weight loss, and sometimes diabetic ketoacidosis.[2] There is a marked rise in the incidence of type 1 diabetes mellitus among children and adolescents worldwide.[3] Treatment involves life-long insulin injections, continuous monitoring of glucose levels in blood, diet control, and patient education.[4]

Complications from type I diabetes mellitus among children include both acute and chronic types of problems. The acute complications include hypoglycemia and diabetic ketoacidosis.[5] These conditions can become serious if not managed early on. On the other hand, the chronic conditions will take some time before appearing in these individuals. These conditions may consist of retinopathy, nephropathy, and neuropathy.[6] It is also important to note that people with this condition can easily develop other autoimmune diseases because of similar immunological problems.[7]

Celiac disease is one of the most common autoimmunities found in people suffering from type 1 diabetes mellitus.[8] Celiac disease is characterized by an immune-mediated attack on the lining of the small intestines due to gluten consumption in people predisposed genetically to the disease.[9] Celiac disease is more common in people with type 1 diabetes mellitus than the general public. Many cases of celiac disease may be without symptoms, while other times they have nonspecific features like abdominal pain, diarrhea, failure to thrive, and anaemia that make diagnosing the condition difficult.[10] Serological testing is recommended for children suffering from type 1 diabetes mellitus.

In pediatric populations suffering from type I diabetes mellitus, there are high incidences of concurrent autoimmune conditions, with celiac disease being one of the most important ones. Nevertheless, cases of celiac disease can be significantly underdiagnosed owing to the absence of overt clinical symptoms. There is a lack of data concerning the prevalence and consequences of celiac disease among patients with type I diabetes mellitus, especially in developing countries, thus making the magnitude of the problem unknown. Therefore, the current study will investigate the prevalence rate of celiac disease among children with type I diabetes mellitus.

METHODOLOGY

This cross sectional study was carried out in the Department of Paediatrics at Lady Reading Hospital over a period from 10 July 2024 to 10 January 2025. Approval was obtained from the institutional ethical review committee of the hospital prior to starting the data collection process. Sample size was calculated by using WHO sample size calculator by taking expected frequency of celiac disease as 11%,[11] confidence level 95%, and margin of error 6%, which gave total sample of 105 children.

Inclusion Criteria

Children aged 02–13 years, both male and female, diagnosed with type l diabetes mellitus as defined above were included.

Exclusion Criteria

Children having Down syndrome, terminal illnesses, or known heart disease were excluded from the study.

Type l diabetes mellitus was taken in those children having symptoms of polydipsia, polyuria, and unexplained weight loss along with any one of the following findings: HbA1c ≥6.5%, fasting plasma glucose ≥126 mg/dL on two separate readings, or already using anti diabetic drugs on history. Before enrolment, informed written consent was taken from parents or guardians after explaining purpose and benefits of the study and assuring that there was no harm involved. Demographic details including age, gender, weight, socio economic status and residence were recorded. Detailed history was taken in all cases and clinical examination was performed. Children were assessed for symptoms suggestive of celiac disease including chronic diarrhoea, abdominal pain, weight loss, and anaemia. The biopsy was taken from the descending portion of the duodenum using aseptic techniques. It was processed in formaldehyde and then stained with hematoxylin and eosin. The sample was viewed under the light microscope, together with morphometric study. The height of the villi and the depth of the crypt were measured, and the ratio between the two was determined. Celiac disease was identified among children who had symptoms such as chronic diarrhea, abdominal pain with a VAS score above 3, weight loss, and anemia, along with the presence of villus-to-crypt ratio below 2.

Data were entered and analysed using SPSS version 26. Numerical variables such as age, weight, and duration of diabetes were expressed as mean ± SD. Categorical variables including gender, celiac disease, family history, socio economic status and residence were presented as frequencies and percentages. Effect modifiers were controlled by stratification for age, gender, weight, duration of diabetes, family history, socio economic status and residence. Post stratification Chi square test or Fisher exact test was applied and p value ≤0.05 was taken as statistically significant.

RESULTS

A total of 105 children with Type I Diabetes Mellitus were included in this study. The mean age of the participants was 7.53 ± 3.24 years, with a mean weight of 21.42 ± 7.88 kg and a mean duration of diabetes of 3.17 ± 1.60 years. Majority of the patients were females, accounting for 57 (54.3%) of the total sample, whilst males constituted 48 (45.7%). With respect to socioeconomic status, most of the children belonged to the middle socioeconomic class, representing 46 (43.8%), followed by low socioeconomic class with 42 (40.0%), and upper class with 17 (16.2%). More than half of the study participants were from rural areas, 57 (54.3%), as compared to 48 (45.7%) from urban areas. A positive family history of diabetes was reported in 30 (28.6%) patients, whereas 75 (71.4%) had no such family history (Table-I).

Table I

Patient Demographics

Demographics	Mean ± SD / n (%)
Age (years)	7.53 ± 3.24
Weight (kg)	21.42 ± 7.88
Duration of Diabetes (years)	3.17 ± 1.60
Gender	
Male n (%)	48 (45.7%)
Female n (%)	57 (54.3%)
Socioeconomic Status	
Upper n (%)	17 (16.2%)
Middle n (%)	46 (43.8%)
Low n (%)	42 (40.0%)
Residence	
Rural n (%)	57 (54.3%)
Urban n (%)	48 (45.7%)
Family History	
Yes n (%)	30 (28.6%)
No n (%)	75 (71.4%)

With regards to the frequency of coeliac disease in the study population, it was found that 40 out of 105 children (38.10%) were diagnosed with coeliac disease, whilst the remaining 65 (61.90%) did not have the condition (Table-II).

Table II

Frequency of Celiac Disease Among Children with Type I Diabetes Mellitus n=105

Celiac Disease	Frequency	% age
Yes	40	38.10%
No	65	61.90%
Total	105	100%

With regard to the association of coeliac disease with demographic variables, a highly significant association were observed between coeliac disease and socioeconomic status (p<0.001), where the prevalence of coeliac disease was notably higher amongst children from the low socioeconomic class, 26 (61.9%), as compared to middle class, 13 (28.3%), and upper class, 1 (5.9%). A significant association were also found between coeliac disease and area of residence (p<0.001), with a considerably higher proportion of coeliac disease amongst rural children, 33 (57.9%), than amongst urban children, 7 (14.6%). Furthermore, a statistically significant association were noted between coeliac disease and family history (p=0.042), as children with a positive family history showed higher rates of coeliac disease, 16 (53.3%), in comparison to those without a family history, 24 (32.0%) (Table-III).

Table III

Association of Celiac Disease with Demographic Factors

Demographic Factors	Sub group	Celiac Disease		p-value
		Yes n (%)	No n (%)	
Age (years)	≤7	19 (37.3%)	32 (62.7%)	0.863

	>7	21 (38.9%)	33 (61.1%)	
Gender	Male	20 (41.7%)	28 (58.3%)	0.489
	Female	20 (35.1%)	37 (64.9%)	
Weight (kg)	≤20	23 (42.6%)	31 (57.4%)	0.329
	>20	17 (33.3%)	34 (66.7%)	
Duration of Diabetes (years)	≤3	22 (43.1%)	29 (56.9%)	0.301
	>3	18 (33.3%)	36 (66.7%)	
Socioeconomic Status	Upper	1 (5.9%)	16 (94.1%)	<0.001*
	Middle	13 (28.3%)	33 (71.7%)	
	Low	26 (61.9%)	16 (38.1%)	
Residence	Rural	33 (57.9%)	24 (42.1%)	<0.001*
	Urban	7 (14.6%)	41 (85.4%)	
Family History	Yes	16 (53.3%)	14 (46.7%)	0.042*
	No	24 (32.0%)	51 (68.0%)	

*Chi-Square Test

DISCUSSION

The frequency of coeliac disease in this study were found to be 38.10%, which is considerably high. This high prevalence can be explained by the shared genetic susceptibility between both conditions, particularly the HLA-DQ2 and HLA-DQ8 haplotypes, which are strongly associated with both Type I Diabetes Mellitus and coeliac disease. These genetic markers predispose the immune system towards abnormal T-cell mediated responses, thus increasing the likelihood of developing both autoimmune conditions simultaneously. A highly significant association were observed between coeliac disease and low socioeconomic status, where 61.9% of children from low socioeconomic background were found to have coeliac disease as compared to only 5.9% from upper class. This findings may be explained by the poor nutritional status, delayed diagnosis, and higher gluten consumption through cheap wheat-based diet which is more common in low income families. Furthermore, the lack of access to health care facilities by patients belonging to low socioeconomic classes may result in increased time under the influence of gluten before being diagnosed with celiac disease. There was also a strong correlation identified between celiac disease and having a family history of the same, where 53.3% of children with a family history tested positive for the disease while only 32.0% did not. The reason for this strong link could be the genetic predisposition to develop celiac disease within families.

The frequency of coeliac disease in the present study were found to be 40/105 (38.10%), which is notably higher than what has been reported in majority of the published literature. Duckworth *et al.* [12] reported a prevalence of 8.2% in 342 children with T1DM, whilst Unal *et al.* [13] found biopsy-confirmed coeliac disease in only 6.9% of their paediatric cohort. Similarly, Anwar *et al.* [14] reported positive coeliac serology in 12.7% and biopsy-confirmed disease in only 5.3%, and Yıldız *et al.* [15] reported a prevalence of 7% in 243 paediatric T1DM patients. Moayeri *et al.* [16] found an even lower prevalence of 3.4% in a case-control design. The comparatively higher frequency observed in the present study may be attributed to the inclusion of serological diagnosis without mandatory biopsy confirmation, as well as the high proportion of children from low socioeconomic and rural backgrounds, where nutritional habits favour heavy wheat-based diets and where access to early medical care is limited, thus resulting in prolonged gluten exposure and delayed diagnosis. However, a closer comparison were found with Jaffar *et al.* [17] who reported a prevalence of 20.4% in a Pakistani paediatric T1DM population, which is more nearer to the present findings and may reflects the similar regional dietary patterns, genetic predisposition, and healthcare access limitations shared within the South Asian context.

With regard to the association of coeliac disease with socioeconomic status and residence, the present study found a highly significant association with low socioeconomic class and rural residence, which has not been frequently examined in the above cited studies. Jaffar *et al.* [17] did report that 53.1% of their study population belonged to middle class, suggesting that socioeconomic factors may influence the disease burden in this region, though a formal statistical association were not drawn in their work. The predominance of coeliac disease in low income and rural children in the present study can be explained on the basis of high dietary gluten load through wheat-based staple foods, poor nutritional status weakening mucosal immune tolerance, and delayed healthcare seeking behaviour.

The significant association between positive family history and coeliac disease, as observed in 16/30 (53.3%) children with family history versus 24/75 (32.0%) without it (p=0.042), supports the well-known hereditary basis of the condition. Chisnoiu *et al.* [18] also emphasised the strong autoimmune overlap and genetic predisposition in their paediatric T1DM cohort, while Jaffar *et al.* [17] noted that family history of coeliac disease were present in 6.1% of their patients, further supporting the role of familial clustering. The shared HLA-DQ2 and HLA-DQ8 genetic haplotypes amongst first-degree relatives provides a plausible biological explanation for the observed familial aggregation of coeliac disease in T1DM children.

However, there are a number of limitations of the current study that need to be taken into consideration. First, the current research was conducted using a single center approach. Thus, the findings cannot be generalized beyond the studied population. Second, the sample size used in the current paper was rather small. In total, 105 participants were included in the study, while the total number of children suffering from Type I Diabetes Mellitus is larger than the sample used in the study. Third, in some cases biopsy could not be conducted in spite of positive test results. Finally, the cross-sectional study design makes it impossible to build any cause-and-effect relationship.

CONCLUSION

Conclusion from the study demonstrates that coeliac disease is common in children suffering from type 1 diabetes mellitus. There are highly related risk factors

such as poor socioeconomic status, rural environment, and positive family history of disease. The study showed no correlation between age, sex, weight, and duration of illness.

REFERENCES

1. Popoviciu, M. S., Kaka, N., Sethi, Y., Patel, N., Chopra, H., & Cavalu, S. (2023). Type 1 diabetes mellitus and autoimmune diseases: A critical review of the association and the application of personalized medicine. *Journal of Personalized Medicine*, *13*(3), 422. https://doi.org/10.3390/jpm13030422
2. Liu, J., Chai, Z., Wang, Y., & Zhang, L. (2025). Global burden of type 1 diabetes in children and adolescents aged 0 to 19: A Multidatabase comparative study, 2021. *Diabetes & Metabolism Journal*, *49*(5), 1126-1128. https://doi.org/10.4093/dmj.2025.0444
3. Xie, J., Li, W., Li, X., Zhang, X., Liu, J., Liu, Z., Jing, S., & Shao, H. (2025). Global, regional, and national epidemiology of type 1 diabetes in children from 1990 to 2021: Trend and health inequality analyses based on the global burden of disease study 2021. *Diabetology & Metabolic Syndrome*, *17*(1). https://doi.org/10.1186/s13098-025-01905-3
4. Friedman, J. G., Cardona Matos, Z., Szmuilowicz, E. D., & Aleppo, G. (2023). Use of continuous glucose monitors to manage type 1 diabetes mellitus: Progress, challenges, and recommendations. *Pharmacogenomics and Personalized Medicine*, *16*, 263-276. https://doi.org/10.2147/pgpm.s374663
5. Foti Randazzese, S., La Rocca, M., Bombaci, B., Di Pisa, A., Giliberto, E., Inturri, T., Militi, D., Lombardo, F., Gitto, E., Salzano, G., & Passanisi, S. (2025). Severe diabetic ketoacidosis in children with type 1 diabetes: Ongoing challenges in care. *Children*, *12*(1), 110. https://doi.org/10.3390/children12010110
6. Bourbon Lopes, J. H., Fonseca, J., Silveira, F., & Castro-Correia, C. (2026). Point prevalence of motor neuropathy in children and adolescents with type 1 diabetes mellitus. *Journal of Diabetes & Metabolic Disorders*, *25*(1). https://doi.org/10.1007/s40200-026-01865-z
7. Alnek, K., Tagoma, A., Metsküla, K., Talja, I., Janson, H., Mandel, M., Vorobjova, T., Oras, A., Sepp, H., Pruul, K., Reimand, K., Simonen, T., Peet, A., Reppo, I., Tammiksaar, K., Lubi, M., Heilman, K., Einberg, Ü., Kisand, K., … Uibo, R. (2025). Comparison of immunological and immunogenetic markers in recent-onset type 1 diabetes among children and adults. *Scientific Reports*, *15*(1). https://doi.org/10.1038/s41598-025-99664-8
8. Schweizer, R., Bung, J. I., Majer, D., Liebrich, F., Herrlich, S., Neu, A., & Ziegler, J. (2025). Celiac disease in children with type 1 diabetes: The usefulness of screening— 25 years of experience in a single center. *Pediatric Diabetes*, *2025*(1). https://doi.org/10.1155/pedi/4717290
9. Mittal, P., Arora, D., Parashar, S., Goyal, R., Khan, A., Chopra, H., Mishra, D. K., Gautam, R. K., & Dhama, K. (2023). Celiac disease: Pathogenesis, disease management and new insights into the herbal-based treatments. *Narra J*, *3*(2). https://doi.org/10.52225/narra.v3i2.147
10. Majsiak, E., Choina, M., Gray, A. M., Wysokiński, M., & Cukrowska, B. (2022). Clinical manifestation and diagnostic process of celiac disease in Poland—Comparison of pediatric and adult patients in retrospective study. *Nutrients*, *14*(3), 491. https://doi.org/10.3390/nu14030491
11. Wajahat H, Rehman R, Khanam A. (2020). Frequency of celiac disease among the children with type I diabetes mellitus. *Pak J Med Health Sci,* 14(3), 1231-3.
12. Duckworth, E., Patel, S., & Makaya, T. (2016). Coeliac disease screening in children with type 1 diabetes mellitus: Is it time for a new approach? *Practical Diabetes*, *33*(8), 277-280. https://doi.org/10.1002/pdi.2055
13. Unal, E., Demiral, M., Baysal, B., Ağın, M., Devecioğlu, E. G., Demirbilek, H., & Özbek, M. N. (2021). Frequency of celiac disease and spontaneous normalization rate of celiac serology in children and adolescent patients with type 1 diabetes. *Journal of Clinical Research in Pediatric Endocrinology*, *13*(1), 72-79. https://doi.org/10.4274/jcrpe.galenos.2020.2020.0108
14. Anwar, A., Nazar, A., Aftab, S., Saeed, A., & Cheema, H. A. (2023). Frequency of celiac disease among children with type I diabetes mellitus. *Annals of Punjab Medical College*, *17*(2), 251-253. https://doi.org/10.29054/apmc/2023.1335
15. Yıldız, F., & Kökenli, F. T. (2023). Prevalence of celiac disease in pediatric patients with type 1 diabetes. *Ümraniye Pediatri Dergisi*, *3*(3). https://pdf.journalagent.com/upd/pdfs/UPD-08370-ORIGINAL_RESEARCH-YILDIZ.pdf
16. Moayeri, H., & Bahremand, S. H. (2007). Prevalence of celiac disease in children and adolescents with type I diabetes mellitus. *Med J Islam Repub Iran,* 18(1), 39-43. https://utoronto.scholaris.ca/items/d4c44242-95d8-4e4f-9c40-7bad3135fc7b
17. Jaffar, M., Qazi, N., Saleem, M., Fatima, M., Iqbal, M., & Jabeen, F. (2025). Celiac disease among patients with type 1 diabetes mellitus. *Pakistan Journal of Health Sciences*, 08-13. https://doi.org/10.54393/pjhs.v6i9.2625
18. Chisnoiu, T., Mihai, C. M., Pantazi, A. C., Balasa, A. L., Mihai, L., Frecus, C. E., Constantin, B. M., Andrusca, A., & Lupu, A. (2024). An overview of celiac disease in childhood type 1 diabetes - A single center experience from south east Romania. *Romanian Journal of Oral Rehabilitation*, *16*(1), 307-317. https://doi.org/10.62610/rjor.2024.1.16.28