



Prevalence and Risk Factors of Type 1 Diabetes Mellitus in Children: A Tertiary Care Experience

Faiqa Shafaq¹, Benash Sarwar², Humaira Fayyaz³, Sarooj Gul⁴

¹ICU, Shifa International Hospital, Islamabad, Pakistan.

²Consultant Dietitian and Community Nutritionist, Institute of Home Sciences / Pak Korea Nutrition Center (PKNC), University of Agriculture, Faisalabad, Punjab, Pakistan.

³Department of Paediatric Unit, DHQ Teaching Hospital, Haripur, KP, Pakistan.

⁴Department of Pediatric, B Ward, Hayatabad Medical Complex, Peshawar, KP, Pakistan.

ARTICLE INFO

Keywords: Type 1 Diabetes Mellitus, Children, Prevalence, Risk Factors, Tertiary Care.

Correspondence to: Sarooj Gul, Department of Pediatric, B Ward, Hayatabad Medical Complex, Peshawar, KP, Pakistan.

Email: saroojgul@gmail.com

Declaration

Authors' Contribution

All authors equally contributed to the study and approved the final manuscript

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 18-03-2025 Revised: 12-05-2025

Accepted: 24-05-2025 Published: 04-06-2025

ABSTRACT

Background: Type 1 Diabetes Mellitus (T1DM) is emerging as public hot wicket mainly among children and the growth rate is highest in low and middle income countries like Pakistan. T1DM is characterized by autoimmune destruction of pancreatic beta cells and requires lifelong insulin therapy and close management. Data on its prevalence and risk factors associated with the infection in Pakistani children, however, are limited. **Objective:** The purpose of this study was to find out the prevalence and principal risk factors in T1DM among the children presenting to a tertiary hospital at Faisalabad, Pakistan. **Methods:** Cross sectional study was carried out using attached hospital Allied Hospital Faisalabad over a six months period (July–December 2024). A total of 384 1–18 years old children were screened. Structured questionnaires and chart reviews were used to collect data on demographics, clinical presentation and potential risk factors. Significant associations were identified by multivariate logistic regression analysis. **Results:** A total of 384 children was diagnosed, including 42 (10.9%) T1DM children. The female predominance (57.1%) and the mean age of 10.2 ± 3.6 years were observed. On the whole, most cases were from urban areas (73.8%), while the majority presented with a family history of the disease (64.3%). 38.1% were found to present with diabetic ketoacidosis. Family history of diabetes (OR: 3.76, $p = 0.002$), early exposure to cow's milk (OR: 2.58, $p = 0.031$) and urban residence (OR: 2.94, $p = 0.022$) were the statistically significant risk factors for diabetes. **Conclusion:** This study reveals that T1DM is highly prevalent in children and early diagnosis and public health intervention are needed. Risk factors that can be modified include family history, urban living and early dietary exposures.

INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) is one of the leading chronic endocrine diseases in Pediatric and Adolescent populations worldwide which is characterized by autoimmune destruction of pancreatic beta cells resulting in absolute insulin deficiency (Kandemir et al., 2024; Ogrotis et al, 2023). Incidence of T1DM has been growing steadily globally, but particularly for children under 15 years of age, especially in low and middle income countries (Vanderniet et al., 2022; Roche et al., 2023) where healthcare systems are not prepared to handle the burden of non communicable diseases. The true burden of T1DM in Pakistan is underreported because of the lack of nationwide registries, hospital based studies however indicate rising number of pediatric cases (Therrell et al., 2024; Gruessner, 2023).

The etiology of T1DM is mostly caused by several genetic and environmental factors: family history of

diabetes, exposure to viral infections, early exposure to cow's milk proteins, being born by cesarean and urbanization (Zorena et al., 2022; Stene et al., 2023). Early recognition and prompt diagnosis of T1DM is important to prevent life threatening complications such as DKA which is still a leading cause of morbidity and mortality at disease onset especially in resource constrained settings (Al-Worafi, 2024; Ansbro et al., 2022). Delayed diagnosis and a lack of knowledge about disease severity among caregivers and primary care providers further contribute to poor presentation associated with the disease in Pakistan leading to preventable hospitalizations and long term complications (Al-Worafi, 2023; Al-Worafi, 2024).

The growing acknowledgment of T1DM as a major public health concern in children, however, is hampered by sparse data on its prevalence as well as risk factors in Pakistani children, especially in terms of tertiary care settings that also reflect referral patterns and severity of

the disease. This information is necessary to create programs for targeted screening of children and public health interventions (Foss et al., 2022; Waqas et al., 2022; Putri et al., 2024).

In view of the foregoing account, the present study is aimed to find out the prevalence and risk factors of T1DM among children falling in the catchment area of a tertiary care hospital in Faisalabad, Pakistan. This study is aimed at contributing to a growing body of evidence for policy formulation and clinical practice improvements in pediatric diabetes care, by identifying patterns in the way presentations happen and in modifiable presentations.

METHODOLOGY

This is a cross-sectional study conducted at the Department of Pediatrics, Allied Hospital Faisalabad which is a major tertiary care centre which served a large pediatric population of the region. The research period covered a period of six months, July to December 2024. New or existing cases of Type 1 Diabetes Mellitus (T1DM) diagnosed in children who were between the ages of 1 and 18 year and attended paediatric clinic in the outpatient department or were admitted during the study period were included. Diagnosis of T1DM was made using standard clinical criteria following American Diabetes Association (ADA) guidelines with criteria of hyperglycemia, insulin deficiency features and life long insulin dependence.

Data on demographic characteristics (age, sex, residence), clinical presentation (symptoms, duration before diagnosis), family history of diabetes and potential risk factors (birth weight, mode of delivery, history of viral infection, duration of breastfeeding, exposure to cow's before 1 year of age) were obtained using a structured, pretested questionnaire. Anthropometrics were noted and where available, HbA1c, fasting blood glucose, C peptide levels were reviewed. Data entry and analysis was carried out using SPSS version 26. Prevalence of T1DM was determined using descriptive statistics and associations between potential risk factors and T1DM were determined using chi-square tests and logistic regression models. Statistical significance was based upon a p-value <0.05. We obtained ethical approval from institutional review board of Allied Hospital Faisalabad before starting the study. Informed consent was obtained from the parents or guardian of all participants.

RESULTS

During study period, total of 384 children aged 1–18 years were screened out of which 42 children (10.9%) were diagnosed with T1DM. Children with T1DM had mean age of 10.2 ± 3.6 years and slightly higher prevalence in females (n=24, 57.1%) as compared to males (n=18, 42.9%). T1DM cases were mainly from the urban areas (n=31, 73.8%) and positive family history of diabetes was recorded in 64.3% (n=27) cases.

The most common presenting symptoms were polyuria (88.1%), polydipsia (83.3%) and weight loss (76.2%). Of them, 16 patients (38.1%) presented with diabetic ketoacidosis (DKA) at presentation.

The risk factors for T1DM identified in the multivariate logistic regression were family history of diabetes (OR: 3.76; 95% CI: 1.65–8.59; p=0.002), urban residence (OR: 2.94; 95% CI: 1.17–7.37; p=0.022) and early exposure to cow's milk (OR: 2.58; 95% CI: 1.09–6.13; p=0.031).

Table 1

Demographic and Clinical Characteristics of Children Diagnosed with T1DM (n = 42)

Characteristic	Frequency (n)	Percentage (%)
Age Group (Years)		
1–5	4	9.5%
6–10	17	40.5%
11–15	15	35.7%
16–18	6	14.3%
Sex		
Male	18	42.9%
Female	24	57.1%
Residence		
Urban	31	73.8%
Rural	11	26.2%
Family History of Diabetes	27	64.3%
Diabetic Ketoacidosis at Presentation	16	38.1%

Table 2

Multivariate Logistic Regression Analysis of Risk Factors for T1DM

Risk Factor	Odds Ratio (OR)	95% Confidence Interval	p-value
Family history of diabetes	3.76	1.65 – 8.59	0.002
Urban residence	2.94	1.17 – 7.37	0.022
Early cow's milk exposure	2.58	1.09 – 6.13	0.031
Viral infection history	1.23	0.53 – 2.85	0.638
Cesarean delivery	1.14	0.49 – 2.68	0.752

DISCUSSION

This present study shows alarming number of Type 1 Diabetes Mellitus (T1DM) diagnosed among children of a tertiary care facility of Faisalabad, having 10.9% patients diagnosed during six months study period out of total screened patients for Diabetes. This finding highlights the increasing burden of T1DM in Pakistan in line with global trends of rapidly increasing incidence of autoimmune diabetes in children and especially in urbanized and developing societies. In our cohort, the mean age at diagnosis was 10.2 years which is in line with the regional data reported earlier and corresponds with typical late childhood and early adolescent onset.

This study also found the female proportion to be higher among T1DM cases but at statistically insignificant difference. Notably, the majority of diagnosed children are urban residents (73.8%) which indicates the involvement of environmental and daily-life factors (e.g., changes in diet, increased exposure to pollutants and change of bacteric environment due to the city way of living). Other studies from South Asia and the Middle East have also indicated higher T1DM rates in urban populations which is in line with this trend.

The affected children had a high rate of positive family history (64.3%) reinforcing the genetic predisposition in pathogenesis of T1DM. Furthermore, our analysis yielded that early exposure to cow's milk was a statistically significant risk factor. The immunological hypothesis that

genetically susceptible individuals will develop autoimmune responses to cow's milk proteins that may be triggered by early introduction of cow's milk proteins is supported by these observations. Factors such as cesarean delivery and previous viral infections, have been proposed to increase the risk for T1DM, but these factors did not achieve statistical significance in our study which may be due to the small sample size or the parental recall bias.

A critical concern with regard to the relatively high frequency of diabetic ketoacidosis (38.1%) at initial presentation is delays in diagnosis and underrecognition of early symptoms by caregivers and primary healthcare providers. All these call for urgent public health awareness campaigns for early detection and timely referral of pediatric diabetes, particularly in the case of high risk families.

Although we acknowledge some limitations to our study, our findings will be of interest to other tertiary care settings, especially within a Pakistani population. Cross sectional design limits inferential causality and the fact that the study is hospital based may overrepresent more severe or symptomatic cases. Furthermore, some risk factors like autoimmune markers and HLA typing could not be done because of limited resources. However, despite these limitations, the study delivers an important epidemiological insight and underscores important modifiable risk factors worthy of further investigation in prospective, community based studies.

REFERENCES

- Kandemir, N., Vuralli, D., Ozon, A., Gonc, N., Ardicli, D., Jalilova, L., Gulcek, O. N., & Alikasifoglu, A. (2024). Epidemiology of type 1 diabetes mellitus in children and adolescents: A 50-year, single-center experience. *Journal of Diabetes*, 16(5). <https://doi.org/10.1111/1753-0407.13562>
- Ogrotsis, I., Koufakis, T., & Kotsa, K. (2023). Changes in the Global Epidemiology of Type 1 Diabetes in an Evolving Landscape of Environmental Factors: Causes, Challenges, and Opportunities. *Medicina*, 59(4), 668. <https://doi.org/10.3390/medicina59040668>
- Vanderniet, J. A., Jenkins, A. J., & Donaghue, K. C. (2022). Epidemiology of Type 1 Diabetes. *Current Cardiology Reports*, 24(10), 1455–1465. <https://doi.org/10.1007/s11886-022-01762-w>
- Roche, E. F., McKenna, A. M., O'Regan, M., Ryder, K. J., Fitzgerald, H. M., & Hoey, H. M. (2023). The incidence of type 1 diabetes in children under 15 years of age is rising again—a nationwide study. *European journal of pediatrics*, 182(10), 4615–4623. <https://doi.org/10.1007/s00431-023-05125-7>
- Therrell, B. L., Padilla, C. D., Gustavo, Khneisser, I., Peter, Knight-Madden, J., Malherbe, H. L., & Kase, M. (2024). Current Status of Newborn Bloodspot Screening Worldwide 2024: A Comprehensive Review of Recent Activities (2020–2023). *International Journal of Neonatal Screening*, 10(2), 38–38. <https://doi.org/10.3390/ijns10020038>
- Gruessner, R. W. (2023). Economic and Insurance Issues. In *Transplantation of the Pancreas* (pp. 1087–1098). Cham: Springer International Publishing.
- Zorena, K., Michalska, M., Kurpas, M., Jaskulak, M., Murawska, A., & Rostami, S. (2022). Environmental Factors and the Risk of Developing Type 1 Diabetes—Old Disease and New Data. *Biology*, 11(4), 608. <https://doi.org/10.3390/biology11040608>
- Stene, L. C., Norris, J. M., & Rewers, M. J. (2023). Risk factors for type 1 diabetes. *Diabetes in America [Internet]*.
- Al-Worafi, Y. M. (2024). Type 1 Diabetes Management in Developing Countries. In *Handbook of Medical and Health Sciences in Developing Countries: Education, Practice, and Research* (pp. 1–46). Cham: Springer International Publishing.
- Ansbro, É., Issa, R., Willis, R., Blanchet, K., Perel, P., & Roberts, B. (2022). Chronic NCD care in crises: A qualitative study of global experts' perspectives on models of care for hypertension and diabetes in humanitarian settings. *Journal of Migration and Health*, 5, 100094. <https://doi.org/10.1016/j.jmh.2022.100094>
- Al-Worafi, Y. M. (2023). Epidemiology and Burden of Neurological Diseases in Developing Countries. In *Handbook of Medical and Health Sciences in Developing Countries: Education, Practice, and Research* (pp. 1–27). Cham: Springer International Publishing.
- Al-Worafi, Y. M. (2024). Common Geriatrics Diseases and Conditions in Developing Countries. In *Handbook of Medical and Health Sciences in Developing Countries: Education, Practice, and Research* (pp. 1–27). Cham: Springer International Publishing.
- Foss, K. S., O'Daniel, J. M., Berg, J. S., Powell, S. N., Cadigan, R. J., Kuczynski, K. J., Milko, L. V., Saylor, K. W., Roberts, M., Weck, K., & Henderson, G. E. (2022). The Rise of Population Genomic Screening: Characteristics of Current Programs and the Need for Evidence Regarding Optimal Implementation. *Journal of Personalized Medicine*, 12(5), 692. <https://doi.org/10.3390/jpm12050692>

Finally, this shows that T1DM is still a relevant and expanding pediatric health issue in our context. Early diagnosis along with targeted education for families at risk and strategic health care planning are critical to improving outcomes and decreasing the burden of complications such as diabetic ketoacidosis. Further research should investigate the interrelations among genetic and environmental factors for the prevention of each disease in specific local populations.

CONCLUSION

In this study it is pointed out a significant burden of Type 1 Diabetes Mellitus (T1DM) among children who are seen referred to Faisalabad, as a high prevalence of 10.9% among screened pediatric cases. Our findings indicate that family history, early exposure to cow's milk and urban residence are all risk factors for T1DM which makes a genetic and potentially modifiable contribution to disease. Delays in diagnosis and a strong message to caregivers and healthcare providers is underscored by the high rate of diabetic ketoacidosis at presentation. Early diagnosis requires targeted screening of high risk children and community based awareness programs and appropriate training at primary health care level. This hospital based nature of the study precludes generalizability but adds important insight in terms of pediatric diabetes epidemiology in Pakistan and emphasizes the need for larger community based research to inform the national policy and pediatric diabetes care strategies.

14. Waqas, A., Koukab, A., Meraj, H., Dua, T., Chowdhary, N., Fatima, B., & Rahman, A. (2022). Screening programs for common maternal mental health disorders among perinatal women: Report of the systematic review of evidence. *BMC Psychiatry*, 22(1).
<https://doi.org/10.1186/s12888-022-03694-9>
15. Putri, L. D., Girsang, E., Lister, I. N. E., Kung, H. T., Kadir, E. A., & Rosa, S. L. (2024). Public health implications for effective community interventions based on hospital patient data analysis using deep learning technology in indonesia. *Information*, 15(1), 41.
<https://doi.org/10.3390/info15010041>