Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(2), 383-388 | ISSN:2251-6727

Impact of the type of Insulin Regimen on Blood Glucose Trends and Frequency of Readmission among Children with Type 1 Diabetes: A Retrospective Study

Ayesha T. Pendhari [1], Madhavi M. Reddy [2*], Sudha Reddy V R [3]

[1] Department of Clinical Nutrition and Dietetics, Sri Devaraj Urs Academy of Higher Education and Research, Kolar.

[2] Department of Clinical Nutrition and Dietetics, Sri Devaraj Urs Academy of Higher Education and Research, Kolar.

[3] Department of Pediatrics, Sri Devaraj Urs Medical College, Kolar.

Corresponding Author*

Dr. Madhavi M. Reddy

Department of Clinical Nutrition and Dietetics, Sri Devaraj Urs Academy of Higher Education and Research, Kolar, Karnataka, India.

(Received: 16 January 2025   Revised: 23 March 2025   Accepted: 27 March 2025)

KEYWORDS

Type 1 Diabetes, children and adolescents, Diabetic ketoacidosis, Multiple Daily Injections, Hospital Readmission, Glycemic Control

ABSTRACT:

Introduction: Type 1 diabetes mellitus (T1DM) is one of most common endocrine diseases in children and adolescents. An effective insulin regimen can help keep blood sugar levels close to normal. Insulin therapy is essential in regulating body's glucose levels. This retrospective study has been conducted to understand better how different insulin regimens affect biochemical parameters in type 1 diabetic children, such as HbA1c and 24 h-glucose values.

Materials and Methods: The secondary data gathered from medical records of 48 children with Type 1 Diabetes Mellitus between ages of 2 and 18 who were hospitalized at R.L. Jalappa Hospital and Research Centre, SDUAHER, Tamaka, Kolar, between January 1, 2016, and December 31, 2020.

Results: The 48 children with Type 1 diabetes were hospitalized during this time. Of these, 42% are male and 58% female participants.16% of children had mild diabetic ketoacidosis, 21% had severe cases, 6% had moderate and 5% had co-morbid conditions, 6 were early childhood, 15 were mid-childhood children and 23 were early adolescents. Participants were administered an insulin regimen, of which 11 were on basal-bolus regimen, 27 were on premix regimen, and six were on fixed-dose regimen.

Conclusion: Insulin therapies are now able to more closely mimic physiologic insulin secretion and thus achieve better glycemic control in patients with diabetes. While comparing fixed proportions of mixed insulins and premix regimens and their less physiologic action, there is an increased risk of hypoglycemia using these insulin preparations compared to basal and pre-meal bolus insulin regimen.

1. Introduction

Type 1 diabetes (T1D) management in children requires consistent insulin therapy to maintain glycemic control and prevent long-term complications. The choice of insulin regimen plays a critical role in blood glucose management, influencing metabolic outcomes, glycemic variability, and long-term health in pediatric patients. However, in resource-limited rural settings, access to advanced insulin regimens, diabetes education, and continuous glucose monitoring is often restricted, leading to suboptimal blood glucose management.

This retrospective study aims to evaluate the impact of different insulin regimens on blood glucose trends

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(2), 383-388 | ISSN:2251-6727

among children with T1D in rural areas with limited healthcare resources. By analyzing the past 5 years of hospitalized T1D patient data, the study will compare multiple daily injections (MDI) with fixed insulin regimens and other available insulin strategies, assessing their effectiveness in achieving glycemic control.

The findings will help identify practical, cost-effective insulin regimens that can be feasibly implemented in rural healthcare settings. This research aims to guide healthcare providers in optimizing diabetes management for children in underserved regions, improving their long-term health outcomes despite resource constraints.

2. Materials and Methods

This retrospective research study was conducted at R.L. Jalappa Hospital and Research Centre, SDUAHER, Tamaka, Kolar. The study focused on children diagnosed with Type 1 Diabetes Mellitus (T1DM) between the ages of 2 and 18 years at the time of diagnosis. The participants were hospitalized for diabetes management between January 1, 2016, and December 31, 2020. Secondary data for this study was collected from medical records, ensuring a comprehensive review of the clinical history, diagnostic findings, treatment protocols, and outcomes of 48 children diagnosed with T1DM. The study aimed to analyze patterns in disease presentation, biochemical parameters (HbA1c levels at baseline and presence of diabetic ketoacidosis (DKA)at diagnosis, hospitalization trends, and management strategies. By utilizing retrospective data, this research provides valuable insights into the prevalence of Type 1 Diabetes Mellitus among children in this region. The findings may contribute to improving early diagnosis, treatment approaches, and long-term disease management strategies (Figure 1)

Statistical analysis: Data were analyzed using descriptive statistics for demographic and clinical characteristics. Comparative analysis of blood glucose control and readmission rates between insulin regimen groups.

3. Results

For the present retrospective study, Table 1 explains that the total sample size was 48, out of which 20 (42%) were male, 28 (58%) were female, and 46% belonged to the lower middle class, whereas 54% were from the upper middle class. Based on the paediatric classification, 13 % belonged to early childhood, 33% belonged to mid-childhood, and 54% were early adolescents.

Table 2 explains, the mean weight for age of the male participants in kgs for early childhood was 15± 4.0, mid-childhood 19.8±3.8, and early adolescence was 38.6±9.7. whereas mean height for age in cm for early childhood was 103±17.4, mid-childhood 125.2±9.8, and early adolescence was 152.3±10.0. The mean body mass index in kg/m2 for early childhood was 14.3±1.71, mid-childhood 12.5±1.35, and early adolescence was 16.4±3.3. The mean weight for age of the female participants in kg of early childhood was 11.7±4.1, mid-childhood 23±4.12, and as in early adolescence, 34.3±9.9. Whereas mean height for age in cm of early childhood was 98.3±17.3, mid-childhood 128.5±8.9, and as in early adolescents 145.6±10.1. The mean body mass index in kg/m2 of early childhood was 13±1.88, mid-childhood 13.9±2.2, and as in early adolescence 15.9±3.4
Figure 2 explains about A total of 48 patients were admitted to the hospital, 29(60%) of whom were newly diagnosed children, 13(27%) were re-admitted once, 1(2%) for the second time, and 5(11%) for the third time.

Graph 2: GRAPHICAL REPRESENTATION OF BLOOD GLUCOSE TREND OF PATIENTS WITH T1DM ON THE DAY OF ADMISSION AND DISCHARGE BASED ON THE INSULIN REGIMEN.
Figure 3, Figure 4, Figure 5 explains the mean difference in blood glucose trend of fasting, pre and postprandial on the day of admission compared with the mean blood glucose trend one day before discharge, the total insulin dose and length of hospital stay were also assessed.
Table 3 explains that out of 48 hospitalised participants, a basal-bolus insulin regimen was prescribed for early childhood (3 out of 6), mid-childhood (5 out of 15), and early adolescents (4 out of 23). While a fixed-dose regimen was prescribed for middle childhood (1 out of

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(2), 383-388 | ISSN:2251-6727

15) and early adolescents (3 out of 23). Premix regimen was recommended for early childhood (3 out of 6), mid-childhood (9 out of 15), and early adolescents (14 out of 23).

4.Discussion

Over the past decade, there has been a significant shift toward Multiple Daily Injections (MDI) and Continuous Subcutaneous Insulin Infusion (CSII) in the treatment of diabetes. In the past, therapies primarily aimed at minimizing painful injections for children, resulting in regimens that offered limited flexibility and strict dietary restrictions. However, today, intensive regimens that involve a more tailored approach to the substitution of basal and prandial insulin have become the gold standard.The findings of this study align with previous research indicating that intensive insulin therapy, such as CSII, is associated with improved glycemic control and reduced hospital readmissions (Danne et al., 2018). Studies have demonstrated that children using CSII exhibit lower HbA1c levels and experience fewer episodes of severe hypoglycemia and DKA compared to those on MDI (Weissberg-Benchell et al., 2016). Additionally, adherence to insulin therapy and family support are crucial in minimizing hospitalizations (Clements et al., 2017). However, barriers such as the cost of insulin pumps, accessibility to technology, and patient preference may influence regimen selection (Sherr et al., 2020). Our study further highlights the need for individualized diabetes management plans that consider socioeconomic and psychological factors to optimize outcomes.

Summary

The 48 children with Type 1 diabetes in total were hospitalised during the study period. Of these, 42% were male, and 58% were female participants.16% of the children had mild diabetic ketoacidosis, 21% had severe cases, 6% had moderate, and 5% had co-morbid conditions. Of them, 6 were early childhood, 15 were mid-childhood children, and 23 were early adolescents. The participants were administered an insulin regimen, of which 11 were on the basal-bolus regimen, 27 were on the premix regimen, and six were on the fixed-dose regimen.

5. Conclusion

The study provides insights into the effectiveness of different insulin regimens in pediatric T1D patients. Understanding the relationship between insulin therapy and hospital read missions can guide individualized treatment plans to improve glycemic control and reduce the burden of hospitalizations.

Insulin therapies can now mimic physiologic insulin secretion and thus achieve better glycemic control in patients with diabetes. While comparing the fixed proportions of mixed insulins and premix regimens and their less physiologic action, there is an increased risk of hypoglycemia using these insulin preparations compared to a basal and pre-meal bolus insulin regimen. Optimizing insulin therapy can significantly reduce hospital readmissions and enhance long-term disease management, ultimately preventing both short- and long-term complications.

Reference

1. Bangstad, H. J., Danne, T., Deeb, L., Jarosz-Chobot, P., Urakami, T., & Hanas, R. (2009). Insulin treatment in children and adolescents with diabetes. Pediatric diabetes, 10 Suppl 12, 82–99. doi: 10.1111/j.1399-5448.2009.00578.x.
2. Weissberg-Benchell, J., Antisdel-Lomaglio, J., & Seshadri, R. (2016). Insulin pump therapy: A meta-analysis. *Diabetes Care*, *26*(4), 1079–1087. https://doi.org/10.2337/diacare.26.4.1079
3. Clements, M. A., Foster, N. C., Maahs, D. M., Schatz, D. A., Olson, B. A., Tsalikian, E.,Eva Tsalikianf , Joyce, M. Leeg, Christine, M. Burt-Solorzanoh., William, V. Tamborlanei., Vincent, Chenb., Kellee, M., Millerb., & Roy W. Beckb. (2017). Hemoglobin A1c values in children and adolescents with diabetes: The T1D Exchange clinic registry. *Pediatric Diabetes*, *17*(7), 502–510. https://doi.org/10.1111/pedi.12301
4. Sherr, J. L., Heinemann, L., Fleming, G. A., Bergenstal, R. M., Petrie, J. R., Peters, A. L., & Schnell, O. (2020). Automated insulin delivery: Benefits, challenges, and recommendations. *The Lancet Diabetes & Endocrinology*, *8*(2), 140–148. https://doi.org/10.1016/S2213-8587(19)30364-8.

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(2), 383-388 | ISSN:2251-6727

Table :1: SOCIO DEMOGRAPHIC PROFILE AND HEALTH DETAILS OF THE PARTICIPANTS

CHARACTERISTICS	No of participants (%)
GENDER	
Male	20 (42)
Female	28 (58)
SOCIO ECONOMIC STATUS	
Lower Middle Class	22 (46)
Upper middle class	26 (54)
PEDIATRIC CLASSIFICATION	
Early childhood 2-5 YO	
Male	3
Female	3
Mid childhood 6-11 YO	
Male	5
Female	11
Early Adolescents 12-18YO	
Male	12
Female	14
MEAN AGE IN YEARS ± SD	
Early childhood 2-5 YO	4.5±0.5
Mid childhood 6-11 YO	9.6±1.55
Early Adolescents 12-18YO	13.8±1.6

Table 2: ANTHROPOMETRIC CHARACTERISTICS OF THE STUDY PARTICIPANTS

Paediatric Age group classification	Weight for age Kgs Mean ± SD		Height for age Cms Mean ± SD		Body Mass Index Kg/M^2 Mean ± SD	
	Male	Female	Male	Female	Male	Female
Early childhood 2-5 YO	15±4.0	11.7±4.1	103±17.4	98.3±17.3	14.3±1.71	13±1.88
Mid childhood 6-11 YO	19.8±3.8	23±4.12	125.2±9.8	128.5±8.9	12.5±1.35	13.9±2.2
Early Adolescents 12-18YO	38.6±9.7	34.3±9.9	152.3±10.0	145.6±10.1	16.4±3.3	15.9±3.4

Table 3: INSULIN REGIMEN ADMINISTERED TO THE PARTICIPANTS

Insulin Therapy (n)					
Paediatric Age group classification	basal-bolus regimen	Fixed-Dose Regimen	Premix Fix Dose regimens	Total daily insulin dose (units)	Number of insulin injections per day
Early childhood 2-5 YO N=6	3	0	3	15.3 ± 2.7	3.0 ± 1.0

Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(2), 383-388 | ISSN:2251-6727

Mid childhood 6-11 YO N=15, 1 DAMA	5	1	9	26.4 ± 10.3	2.7 ± 0.9
Early Adolescents 12-18YO N=23, 3 DAMA	4	5	14	40.13 ± 9.7	2.5 ± 0.8

Figure 1 Flow diagram of a retrospective study

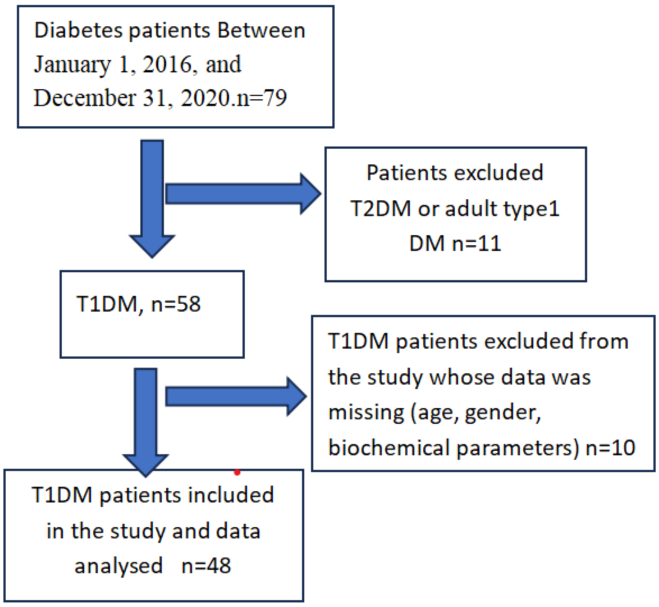
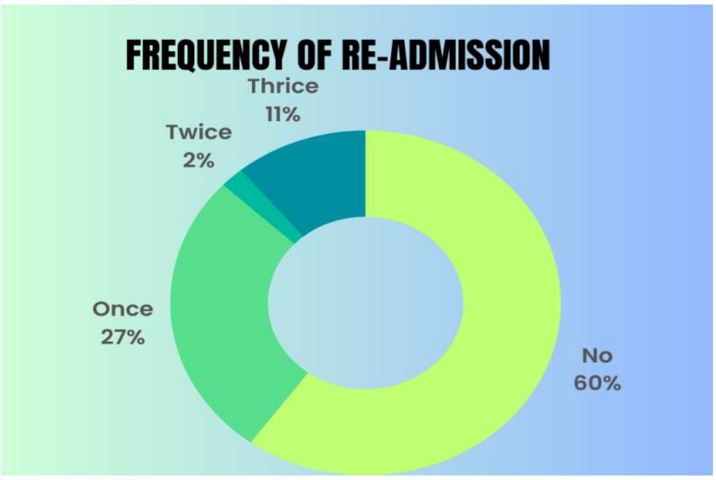


Figure : 2

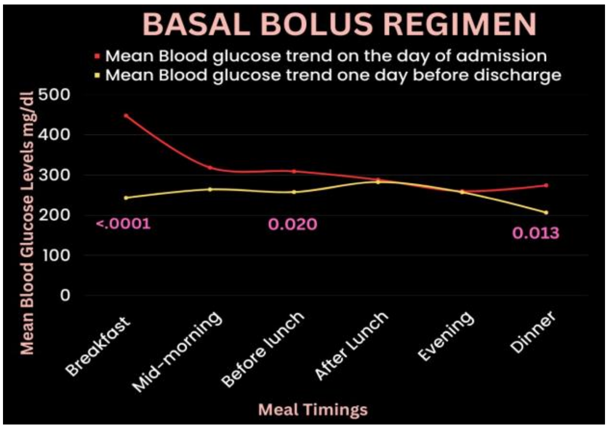


Journal of Chemical Health Risks

www.jchr.org

JCHR (2025) 15(2), 383-388 | ISSN:2251-6727

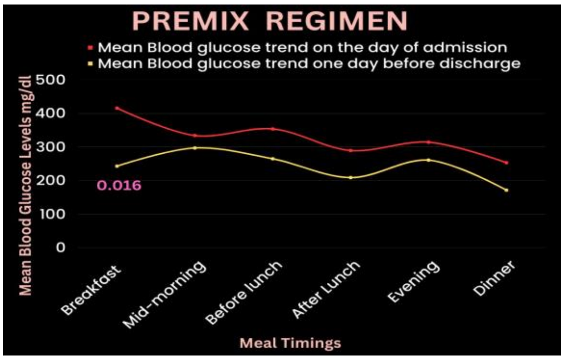
Figure : 3



Significant difference in the mean blood glucose trend on the day of admission compared with mean blood glucose trend one day before discharge at the following meal times

Breakfast p<0.001
Before Lunch p=0.020
Dinner p=0.013

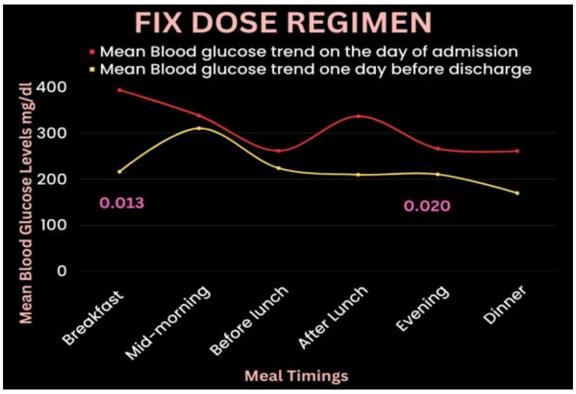
Figure : 4



Significant difference in the mean blood glucose trend on the day of admission compared with mean blood glucose trend one day before discharge at the following meal times

Breakfast p=0.016

Figure : 5



Significant difference in the mean blood glucose trend on the day of admission compared with mean blood glucose trend one day before discharge at the following meal times

Breakfast p=0.013
Evening p=0.020
Dinner p=0.013