To Assess the Effect of Tight Glycemic Control on Complications of Diabetes for the Person with Type 1 Diabetes - Cross-Sectional Study

Dr. Meenaksi Bajpai 1st, Dr. Ankur Saxena 2nd, Dr. Surabhi Saxena 3rd, Dr Anand Saxena 4th, Dr. Moneesh Saxena 5th
Shri Aurobindo Medical Research Centre Raipur Chhattisgarh, India

Abstract
Aim- the current study aims to assess the prevalence of poor glycemic control and associated factors among outpatients with T1DM attending a diabetes clinic at a regional referral hospital. **Methods**: From January 2016 to June 2018, a cross-sectional study examined the variables linked to poor glycemic management. study was out in the ophthalmology department of the Shri Aurobindo Medical Research Centre in Raipur, Chhattisgarh, India. **Results:** Of the 178 participants enrolled in the study, the mean age was 14.95 years, 89 (50%) of the participants were male and 89 (50%) are female. Clinical and diabetes specific factors associated with poor glycemic control Overweight participants had significantly better glycemic control when compared to the other BMI groups, and this was statistically significant P = .000. clinical and diabetes mellitus related factors with p value <0.05 in the analysis of variance were run using multivariate regression analysis to control for possible confounders and modifiable effects and to study their significance risk on glycemic control. The result indicated that higher BMI, type of insulin (actrapid and insulatard) and guardian education were significantly associated with better glycemic control, P< 0.05.The association between non-proliferative diabetic retinopathy (NPDR) showed that significantly associated with Clinically Significant Macular Edema (CSME) was 23.9 % (19.8–28.6), however, the overall presence of NPDR was statistically insignificant **Conclusions:** The study discovered a relationship between glycaemic control—which is still very low in children, adolescents, and young adults with T1DM who visit these clinics—and guardian education achievement, BMI, and type of insulin. Some particular actions that might be taken to promote diabetes education include raising the general literacy rate, hosting regular diabetes camps with support and instructional activities, and offering diabetes education materials that focus both prevention and treatment.
Keywords: Diabetes, Eye Care Health Service Utilization, Diabetic Retinopathy, Non-Proliferative Diabetic Retinopathy

1. Introduction

Diabetes is a metabolic ailment. This means it impacts a person's metabolism, which is how the frame makes power from food. Diabetes causes a person to have hyperglycemia or excessive blood sugar. The extended risk of morbidity and mortality from vascular complications in diabetic instances is related to genetic elements, accelerated glucose levels, high blood pressure, weight problems, oxidative strain, blood lipid sicknesses, and smoking(1). The habitual hyperglycemic condition alters cellular membrane permeability to cations and transmembrane capability(2). Due to constant oxidative strain in diabetic cells, hyperpolarization is responsible for the long-term headaches of diabetes(4,5). Sozmenet al. (6) pronounced that uncontrolled diabetes is answerable for glucose vehicle-oxidation, nonenzymatic protein glycation, and polyol pathway activation with elevated oxidative strain.

Type 1 diabetes mellitus accounts for simplest about 5%–10% of all instances of diabetes. The prevalence of T1DM continues to boom globally, and it has extreme brief-time period and long-term implications. India accounts for most of the kids with T1DM in South-East Asia. Consistent with the sixth version of the Worldwide Diabetes Federation diabetes atlas, India has 3 new instances of T1DM 100,000 children of

0–14 years.[7] the prevalence of diabetes in India is variable, and 3 units of information display 17.93 instances/100,000 children in Karnataka, 3.2 instances 100,000 kids in Chennai, and 10.2 instances 100,000 children in Karnal (Haryana).[8,9,10] The bottom line remains that T1DM is quite prevalent and common.
Terrible glycemic management can result in microvascular complications (retinopathy, neuropathy, and nephropathy) in addition to macrovascular complications (CVA, coronary arterial disorder, and peripheral vascular disorder). But strict glycemic control can save you from these same complications though there can be a danger of hypoglycemia.[11] the current study aims to assess the prevalence of poor glycemic control and associated factors among outpatients with T1DM attending a diabetes clinic at a regional referral hospital.

2. Methods

Study Design and Setting- This cross-sectional study conducted from January 2016 to June 2018 looked at the factors associated with poor glycemic control.

Subjects T1DM study participants 380 and were registered at the centre Shri Aurobindo Medical Research Centre Raipur Chhattisgarh, India. Selection of participants Convenience sampling and a total of 136 participants were excluded either because they were stay in other city or far away and live in village, lost to follow-up or the caretaker was unavailable to give consent to study participation. 53 participants are not filling the questionnaire properly, therefore a total of 191 subjects were interviewed and among these 13 did not meet the study criteria and were excluded from the analysis. The remaining 178 participants were recruited by convenience sampling and were followed up over the six-month period.Inclusion criteria- the research subjects were all attending T1DM clinics in Shri Aurobindo Medical Research Centre Raipur Chhattisgarh, India. Exclusion criteria Those who did not consent to take part in the study and were aged less than 1 year.

The dependent variable was glycemic control and numerous independent variables were assessed including sociodemographic, clinical and diabetes related variables. Data was collected during a short oral interview and a questionnaire consisting of 38 questions which had been translated into the Hindi Language and were filled out by the participant and caretaker if participant was a child or adolescent or only by the participant how full fill the criteria.5 questions were assigned to sociodemographic details, 15 questions were clinical or diabetes related, 15 question each was assigned to diet and exercise and 10 questions concerned psychological factors in relation to T1DM. The participants were then taken to a separate room where they received a full explanation of the research and the aims. Filling of the questionnaire was assisted by the principal investigator and assign two assistants with an interview duration of approximately 25 to 45 minutes. HbA1c levels were measured and recorded to assess the average glycemic control in the previous 3 months.

Data was analyzed using computer IBM- SPSS Version 26 software for further statistical analysis. The descriptive analysis had done using frequency and proportion, mean, variance, paired t-test, and frequency tables and graphs used for presenting the information. The finding decided to use crude and adjusted or with a 95% confidence interval. were used to check for factors associated with glycemic control and a P-value < .05 was considered statistically significant

3. Result

Table no.1: Socio-demographic characteristics of the study participants

Variables	Categories	Frequency	Percentage
Age in Years	Below <10 Years	36	20.22%
	Between 11-18 Years	93	52.24%
	Above >19 Years	49	27.52%
Sex of Children	Male	89	50%
	Female	89	50%
Education background	Below Primary	28	15.73%
	Primary	67	37.64%
	Secondary /Above	83	46.62%
Residence	Urban	79	44.38%
	Rural	99	55.61%
Primary Care	Father	58	32.58%
	Mother	92	51.68%
	Others	28	15.73%
Guardian Education Background	<Primary	79	44.38%
	Secondary	67	37.64%
	College/Above	32	17.97%

Table 1 shows the socio-demographic characteristics of the study participants. Of the 178 participants enrolled in the study, the mean age was 14.95 years, 89 (50%) of the participants were male and 89 (50%) are female. 83 (46.62%) children had at least achieved a secondary education. The primary care giver most frequently reported was the mother that accounted for 92(51.68%) of the participants, followed by fathers 58 (32.58%) of the participants and only 28(15.73%) reported having another primary caretaker. The majority of the caretakers 79 (44.38%) had achieved a primary education.

Regarding for clinical and diabetes related characteristics, about 26(14.60%) were obese, 8(4.49%) overweight, 79(44.38%) had normal weight and 65 (36.51%) were underweight. The majority 60(33.70%) of the participants received > 2 insulin injections per day and most 156(87.64%) used Soluble and insulatard insulin injections. 82(46.06%) received insulin dose <0.8 units/kg, 76 (42.69%) received 0.9-1.2 units/kg, and 20 (11.23%) received 1.2 units/kg. Around 112(62.92%) reported never missing insulin injections, 20 (11.23% are missed one time, and 46 (25.84%) are missed two or more time, children doing physical exercise143 (80.33%) are stopped exercise, 16 (8.98%) are doing very little, and 19 (10.67%) are doing all time and history of stigmatization was less reported by the participants, as only 52(29.21%) were reported feeling stigmatized (Table 2).

Table no. 2:Clinical and diabetic specific characteristics of the participants

	Categories	Frequency	Percentage
BMI	Underweight	65	36.51%
	Normal Weight	79	44.38%
	Overweight	8	4.49%
	Obese	26	14.60%
Duration of Diabetes	<5	92	51.68%
	>5	86	48.31%
Number of Insulin Injections	0-2	118	66.29%

	>2	60	33.70%
Stigmatized in Last 3 Months	No	126	70.78%
	Yes	52	29.21%
Type of Insulin	Soluble and Insulatard	156	87.64%
	Others	22	12.35%
Insulin Doses	<0.8 units/kg	82	46.06%
	0.9-1.2 unit/kg	76	42.69%
	>1.2 unit/kg	20	11.23%
Missed Injections	One time	20	11.23%
	Two or more time	46	25.84%
	None	112	62.92%
Exercise	All time Doing	19	10.67%
	Very Little	16	8.98%
	Stopped	143	80.33%

Most of the participants 168 had poor glycaemic control. which indicates that a large group of the participants had poor glycaemic control.Children aged < 10 years had good glycemic control when compared to adolescents and above>19 years young adults which was statistically significant P = .000. Adolescents were more likely to have poor glycemic control when compared to other groups, (HbA1c 15.54%), which was even higher than the overall mean HbA1c. The T1DM participants of caretakers who had achieved a college education and above had better HbA1c compared to the T1DM participants of less educated caretakers and this was statistically significant P = .080. (Table 3).

Table no.3: Socio-demographic factors associated with poor glycaemic control

Variables	Categories	Mean	SD	95% Confidence Interval of the Difference		p- value
				Lower	Upper	
Age in Years	Below <10 Years	3.54	4.503	2.61	4.46	.000
	Between 11-18 Years	15.54	15.367	12.37	18.70	
	Above >19 Years	11.10	10.624	8.91	13.28	
Education background	Below Primary	.30	.461	.21	.40	.023
	Primary	.72	.451	.63	.81	
	Secondary /Above	.89	.311	.83	.96	
Primary Care	Father	.62	.487	.52	.72	.923
	Mother	.99	.104	.97	1.01	
	Others	.30	.461	.21	.40	
Guardian Education Background	<Primary	.85	.360	.78	.92	.080
	Secondary	.72	.451	.63	.81	
	College/Above	.34	.478	.25	.44	

Clinical and diabetes specific factors associated with poor glycemic control Overweight participants had significantly better glycemic control when compared to the other BMI groups, and this was statistically significant P = .000. Insulin regime was associated with glycemic control and the result was statistically significant at <0.05 level, those who had Soluble and Insulatardhad better glycemic control (HbA1c mean.99 ± SD .079) when compared to those who had other insulin regimens (mixed or only soluble), (HbA1c mean .14 ± SD .345); (see Table 4).

Table no. 4: Clinical and diabetes specific factors associated with poor glycaemic control

Variables	Categories	Mean	SD	95% Confidence Interval of the Difference		p- value
				Lower	Upper	
BMI	Underweight	.81	.393	.73	.90	.000
	Normal Weight	.99	.112	.96	1.01	
	Overweight	.10	.302	.03	.17	
	Obesity	.33	.471	.22	.43	
Duration of Diabetes	<5	.99	.104	.97	1.01	.252
	>5	.91	.282	.86	.97	
Type of Insulin	Soluble and Insulatard	.99	.079	.98	1.01	.000
	Others	.14	.345	.08	.19	
Insulin Dose	<0.8 units/kg	.99	.110	.96	1.01	.904
	0.9-1.2 unit/kg	.92	.280	.85	.98	
	>1.2 unit/kg	.24	.430	.15	.33	

In the final model, socio-demographic, clinical and diabetes mellitus related factors with p value <0.05 in the analysis of variance were run using multivariate regression analysis to control for possible confounders and modifiable effects and to study their significance risk on glycemic control. The result indicated that higher BMI, type of insulin (actrapid and insulatard) and guardian education were significantly associated with better glycemic control, P<0.05.

The association between non-proliferative diabetic retinopathy (NPDR) showed that significantly associated with Clinically Significant Macular Edema (CSME) was 23.9 % (19.8–28.6), however, the overall presence of NPDR was statistically insignificant. The analysis depicts that, Persons living with Diabetes doubles the likelihood of experiencing severe non-proliferative diabetic retinopathy with Clinically Significant Macular Edema compared with their counterparts who utilize eye care health service

4. Discussion

The key finding from this look is that 168 have a look at individuals had negative glycemic manage (HbA1c >8.5%) with a median HbA1c turned into 12.3 ± 2.2%. Factors related to glycemic control had been BMI, insulin type and caretaker educational success and it became discovered that the prevalence of DKA was simplest 10.7% at analysis of T1DM.

The purpose for this will be that people with a higher BMI have much less intense metabolic decompensation and for this reason simpler and less difficult to manipulate diabetes unlike folks that are underweight and feature absolute loss of insulin which leads to catabolic kingdom and vast weight reduction. Barbara Corkey introduced the concept of hyperinsulinaemia as a risk factor for obesity [12]. researcher suggested that environmental agents, such as food additives, toxins or excess iron, which have entered the food chain since 1980, might cause insulin hypersecretion [12, 13]. Insulin regime used became notably related to HbA1c considering that the ones members who were the use of soluble and insulated in separate injections (n = 156) had an HbA1c of mean .99 ± .079,even as those using different insulin combinations (n = 22) inclusive of mixtard or handiest soluble had HbA1c mean .14 ± .345. Patients with type 1 diabetes will need to continue to take their insulin and strive for a caloric reduction of 500–700

kcal/day to lose weight. The ADA recommends that adults with type 1 diabetes meet the CDC recommendations for physical activity for all adults—150 min/week of moderate aerobic activity and two sessions of resistance training per week.[14]

Caretaker training is substantially associated with HbA1c and the outcomes showed that the maximum n = 79 of the caretakers had only achieved a primary level education and this was associated with highest HbA1c (0.85 ± .360%). The level of HbA1c declines with growing level of educational attainment, (.72 ± .451%) for secondary college stage and (.34 ± .478) for college degree schooling and beyond. Literature has shown that parents training performs a main role within the glycemiccontrol of a child with T1DM. Professional fathers have children with good glycemic control. Those findings are consistent with previous studies using the same method of our data collection, which have also proved that lower socioeconomic status which mainly results from unemployment of parents is related with higher HbA1c [15-18].Those with parents having higher educational level showed higher perceived parental support. This is consistent with the results of Gecková et al.[19] and Jafari et al.[20] The level of parent's education was one of the factors influencing the BST in adolescents. Patistea[21]also reported a positive relationship of parents' education and socioeconomic status with their coping behaviors in children; those with higher level of education and socioeconomic status were most helpful in maintaining family strength and an optimistic outlook, and they had better perception of the child's diseases.Those with decrease academic success may be much less probable to understand components of diabetes control which include but no longer limited to training about insulin remedy, diet, blood glucose monitoring and physical hobby in T1DM. As a result, schooling materials must also be adapted to populations with negative analyzing abilities.
Globally, the prevalence of diabetes is rising in both high- and low-income nations, and the consequences of this condition are serious public health concerns that call for routine eye exams to prevent related vascular complications such retinopathy [22]. If diabetes is not properly managed, there is a very significant risk of developing diabetic retinopathy (DR) [23–25]. According to estimates, the prevalence of DR is 2.7% worldwide, with 33.8% of cases occurring in Africa [26].

According to this study, 65% of individuals with proliferative diabetic retinopathy also had diabetic retinopathy (DR), of which 41 % had moderate-to-severe non-proliferative retinopathy and 32.9% had severe non-proliferative retinopathy. Higher baseline hemoglobin A1c (HbA1c) levels in diabetic individuals were linked to higher incidence of retinopathy, retinopathy progression, and proliferative retinopathy progression, according to the Wisconsin Epidemiologic Study. [28, 29] The Diabetes Control and Complications Trial [30] (DCCT) compared intensive insulin therapy (insulin pump or multiple daily injections) versus conventional therapy (one or two injections per day) in 1,441 patients with type 1 DM (615 with mild to moderate retinopathy).

Even after completing every action in this article, the question remains: what more can be done to address the challenges associated with glycemic control? Negative glycemic control is most likely solved by diabetes education, but it's also important to address the barriers to glycemic targets, which may include governments funding diabetes programs more heavily in relation to communicable than non-communicable diseases. Regarding diagnosis: inadequate infrastructure, negative screening and monitoring, lack of knowledge about the condition, most of cases going undiagnosed. In terms of therapies, there aren't many T1DM specialists, access to, availability, and price of insulin is limited, there isn't enough education about T1DM for kids, families, and communities, and there aren't any therapy recommendations.

5. Conclusions and Recommendation

According to WHO research, diabetic retinopathy is a major factor in patient blindness [31]. The study found that BMI, type of insulin, and guardian education achievement were linked with glycaemic control, which is still very low in children, adolescents, and young adults with T1DM who frequent these clinics. Improving general literacy rates, holding frequent diabetes camps with support and educational activities,

and providing materials for diabetes education that emphasizes both prevention and treatment are some specific steps that might be implemented to improve diabetes education.

Comprehensive diabetes care should be available to children and their families, encompassing both medical and psychosocial assistance. In order to address the needs of diabetic care in both urban and rural health facilities, there should be an adequate number of healthcare professionals with a diabetes expertise and training. To educate kids, their families, and the general public, continuing education is crucial on many levels.

6. Strengths and Limitations

There are limitations in the use of HbA1c as an assessment tool for assessing glycemic control as it is affected by haemoglobinopathies, certain forms of anemia or other conditions affecting turnover of red blood cells which were not screened for in our study. and it's a short-term and area-based study to study the long-term Effects of Tight Glycemic control on Complications of Diabetes for the person with Type 1 Diabetes.

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