

## Original Research Article

# A STUDY OF DEPRESSION AND ANXIETY IN ADOLESCENTS WITH TYPE 1 DIABETES MELLITUS

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## ABSTRACT

**Background:** Type 1 Diabetes Mellitus (T 1 DM) is a chronic autoimmune disorder requiring lifelong insulin therapy and continuous self- management. Adolescents with T 1 DM are particularly vulnerable to psychological distress due to the challenges of maintaining glycaemic control amid developmental, social, and emotional changes. Research shows that depression and anxiety are more prevalent among adolescents with T 1 DM than among healthy peers, and these conditions are linked to poorer adherence to treatment, suboptimal glycaemic control, and reduced quality of life. In India, limited mental health resources, social stigma, and barriers to specialised care may exacerbate these issues. Therefore, assessing depression and anxiety in this population is essential for developing comprehensive care strategies that improve both psychological well- being and diabetes management. The objective is to study the prevalence and severity of depression and anxiety among adolescents with T 1 DM and their relationship with HbA1c levels.

**Materials and Methods:** This 12-month cross-sectional study in the Department of Endocrinology at King George Hospital, Visakhapatnam, included 60 adolescents aged 10–19 years with Type 1 Diabetes Mellitus who had been diagnosed at least 6 months earlier. Participants were recruited via convenience sampling after obtaining written consent from parents or guardians. Data on sociodemographic, HbA1c, and illness duration were collected. Anxiety and depression were assessed using the HAM- A and HAM- D scales. Data were analysed in SPSS 28.0. 0 using descriptive statistics, Chi- square, and Spearman's correlation;  $p < 0. 05$  was considered significant.

**Results:** The study found poor glycaemic control, with most participants exhibiting elevated HbA1c levels. Anxiety symptoms were highly prevalent, whereas depressive symptoms were less common and generally mild. Although no significant association was found between HbA1c levels and anxiety or depression, anxiety and depression showed a strong positive correlation. These findings emphasise the importance of regular psychological screening and holistic care for adolescents with T1DM to support both metabolic and emotional well-being.

**Conclusion:** The study found high anxiety and lower depression among adolescents with T 1 DM, along with poor glycaemic control. While anxiety and depression were strongly linked, neither was significantly associated with HbA1c levels. These findings emphasise the need for routine psychological screening and psychosocial support to enhance emotional well- being and health outcomes.

**Keywords:** Type 1 Diabetes Mellitus, Adolescents, Depression, Anxiety.

## INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) is a chronic autoimmune disorder characterised by the destruction of pancreatic  $\beta$ -cells, resulting in an absolute insulin deficiency and necessitating lifelong insulin therapy (American Diabetes Association [ADA], 2025).<sup>[1]</sup> It ranks among the most prevalent chronic endocrine disorders affecting children and adolescents globally. Effective management of T1DM mandates continuous blood glucose monitoring, insulin administration, dietary regulation, and regular physical activity. Adolescence is a critical developmental period marked by rapid physical, psychological, and social transformations, making diabetes management especially challenging. The demands of maintaining strict glycaemic control, fears of hypoglycaemia, concerns about future complications, and the aspiration for independence may contribute to psychological distress. Consequently, adolescents with T1DM face an elevated risk of depression and anxiety relative to their healthy peers (Hood et al., 2006; Delamater, 2009).<sup>[2,3]</sup>

The worldwide burden of Type 1 Diabetes Mellitus (T1DM) and its associated mental health disorders among adolescents has emerged as an escalating public health issue. According to the International Diabetes Federation (IDF, 2025), approximately 589 million individuals globally are affected by diabetes, including a considerable number of children and adolescents diagnosed with T1DM.<sup>[4]</sup> Recent systematic reviews indicate that depression and anxiety are notably more prevalent among adolescents with T1DM compared to the general adolescent population. Alimohamadi et al. (2021) reported pooled prevalence rates of approximately 22% for depression and 18% for anxiety within this demographic.<sup>[5]</sup> Moreover, psychological disorders in adolescents with T1DM have been consistently correlated with poorer glycemic control, elevated glycated haemoglobin (HbA1c) levels, increased hospitalisation rates, and a heightened risk of diabetes-related complications (Buchberger et al., 2016).<sup>[6]</sup> These findings underscore the considerable global burden of psychological comorbidities in adolescents living with T1DM.

In India, the burden of diabetes ranks among the highest globally, with the prevalence of T1DM among children and adolescents continuing to escalate (International Diabetes Federation, 2025).<sup>[4]</sup> While considerable focus has been placed on Type 2 diabetes, the psychosocial challenges encountered by adolescents with T1DM remain insufficiently addressed. Limited access to specialized diabetes care, financial limitations, social stigma, and inadequate mental health resources may further intensify emotional distress within this population. Research conducted in India indicates that adolescents with T1DM frequently exhibit symptoms of anxiety and depression, which

adversely impact self-care behaviors, insulin adherence, and metabolic regulation (Kalra & Jena, 2018).<sup>[7]</sup> Poor psychological well-being has also been associated with diminished quality of life and an elevated risk of long-term diabetes complications, thereby underscoring the necessity for comprehensive care that encompasses both physical and mental health considerations.

Investigating depression and anxiety among adolescents with T1DM is therefore of significant clinical and public health importance. Early identification and management of psychological distress can improve treatment adherence, glycaemic outcomes, and overall quality of life (ISPAD Clinical Practice Consensus Guidelines, 2022).<sup>[8]</sup> Furthermore, understanding the prevalence and determinants of depression and anxiety in this population can inform the development of integrated care models that incorporate routine mental health screening into diabetes management programmes. The findings of the present study may provide valuable evidence for healthcare professionals, policymakers, and researchers, enabling the design of targeted interventions to improve both psychological well-being and diabetes outcomes among adolescents with T1DM, thereby contributing to the advancement of paediatric endocrinology and adolescent medicine.

## MATERIALS AND METHODS

**Study Setting:** Endocrinology department, King George Hospital, Visakhapatnam

**Study Design:** Cross-sectional observational study.

**Study Period:** 12 months

**Study Population:** Patients with Type 1 DM in the outpatient and inpatient sections of the Department of Endocrinology at King George Hospital, Visakhapatnam.

**Sampling Method:** Convenience Sampling.

**Sample Size:** 60

### Inclusion Criteria

- 1) Patients aged 10 to 19 years who have been diagnosed with Type 1 DM for at least 6 months.
- 2) Patients whose parents provided valid, written, informed consent.

### Exclusion Criteria

- 1) Patients whose parents did not provide valid, written, informed consent.
- 2) Chronic illnesses or chronic use of drugs other than insulin for Type 1 DM.
- 3) Presence of other comorbid psychiatric disorders, such as schizophrenia, bipolar affective disorder, and obsessive-compulsive disorder.

### Study Tools

1. Hamilton Anxiety Rating Scale (HAM-A)
2. Hamilton Depression Rating Scale (HAM-D)

**Study Procedure:** The study was conducted after obtaining clearance from the institutional ethics committee and approval from the relevant authorities. Eligible subjects were recruited from the endocrinology department of King George Hospital, Visakhapatnam. Sociodemographic details of the subjects were obtained. Clinical characteristics, including HbA1C status and duration of illness, were recorded. The prevalence and severity of depression were recorded using the HAM-D scale, and anxiety was recorded using the HAM-A.

## Statistical Analysis

Data were analysed using SPSS version 28.0. Descriptive analyses of all explanatory and outcome variables were conducted using frequencies and proportions for categorical variables and means and standard deviations (SDs) for continuous variables. A chi-square test was used to assess associations between HbA1c status and adolescent stage. Spearman's correlation analysis was conducted to assess relationships among HbA1c levels, anxiety severity (HAM-A), and depression severity (HAM-D). Significance was set at  $p < 0.05$ .

## RESULTS

**Table 1: Sociodemographic Characteristics of the Study Sample (N = 60)**

| Age-wise distribution of the sample                          |                   |             |                    |             |                  |
|--------------------------------------------------------------|-------------------|-------------|--------------------|-------------|------------------|
| AGE                                                          | 10-11 years       | 12-13 years | 14-15 years        | 16-17 years | 18-19 years      |
| N                                                            | 5                 | 16          | 15                 | 12          | 12               |
| %                                                            | 8.3%              | 26.7%       | 25%                | 20%         | 20%              |
| Range: 10-19 years; Mean Age: 14.87 years; SD: 2.56          |                   |             |                    |             |                  |
| Gender-wise distribution of the sample                       |                   |             |                    |             |                  |
| Gender                                                       | Male              |             |                    | Female      |                  |
| N                                                            | 28                |             |                    | 32          |                  |
| %                                                            | 46.7%             |             |                    | 53.3%       |                  |
| Distribution of the sample based on the Domicile             |                   |             |                    |             |                  |
| Domicile                                                     | Rural             |             |                    | Urban       |                  |
| N                                                            | 47                |             |                    | 13          |                  |
| %                                                            | 78.3%             |             |                    | 21.7%       |                  |
| Distribution of the sample based on the stage of Adolescence |                   |             |                    |             |                  |
| Adolescence                                                  | Early Adolescence |             | Middle Adolescence |             | Late Adolescence |
| N                                                            | 31                |             | 12                 |             | 17               |
| %                                                            | 51.7%             |             | 20%                |             | 28.3%            |
| Religion-wise distribution of the sample                     |                   |             |                    |             |                  |
| Religion                                                     | Hindu             |             | Muslim             |             | Christian        |
| N                                                            | 52                |             | 2                  |             | 6                |
| %                                                            | 78.3%             |             | 3.3%               |             | 10%              |
| Education-wise distribution of the sample                    |                   |             |                    |             |                  |
| Education                                                    | School            |             | College            |             | Dropout          |
| N                                                            | 39                |             | 18                 |             | 3                |
| %                                                            | 65%               |             | 30%                |             | 5%               |

A total of 60 adolescents participated in the study. The participants' ages ranged from 10 to 19 years, with a mean of  $14.87 \pm 2.56$  years. The largest proportion of participants was in the 12–13-year age group (26.7%), followed by the 14–15-year age group (25.0%). Females constituted 53.3% of the sample, whereas males accounted for 46.7%. The majority of participants resided in rural areas (78.3%). Regarding the stage of adolescence, more

than half of the participants were in early adolescence (51.7%), followed by late adolescence (28.3%) and middle adolescence (20.0%). Most participants identified as Hindus (86.7%), with Christians accounting for 10.0%, and Muslims representing 3.3%. In terms of educational status, 65.0% were enrolled as school students, 30.0% were attending college, and 5.0% were dropouts.

**Table 2: Clinical Characteristics of the Study Sample**

| HbA1C status-wise distribution of the sample                               |              |                   |       |                    |       |                  |       |            |
|----------------------------------------------------------------------------|--------------|-------------------|-------|--------------------|-------|------------------|-------|------------|
| HbA1C                                                                      |              | Normal            |       | Prediabetic        |       | Diabetic         |       |            |
| N                                                                          |              | 0                 |       | 2                  |       | 58               |       |            |
| %                                                                          |              | 0                 |       | 3.3%               |       | 96.7%            |       |            |
| Distribution of the sample based on the duration of illness                |              |                   |       |                    |       |                  |       |            |
| Duration                                                                   |              | 1-3 years         |       | 4-6 years          |       | 7-9 years        |       | ≥ 10 years |
| N                                                                          |              | 24                |       | 22                 |       | 7                |       | 7          |
| %                                                                          |              | 40%               |       | 36.7%              |       | 11.7%            |       | 11.7%      |
| Distribution of HbA1C status and Duration of illness using Chi-Square Test |              |                   |       |                    |       |                  |       |            |
| Variables                                                                  | Category     | Early Adolescence |       | Middle Adolescence |       | Late Adolescence |       | P- Value   |
|                                                                            |              | N                 | %     | N                  | %     | N                | %     |            |
| HbA1C                                                                      | Pre-diabetic | 0                 | 0     | 2                  | 16.7% | 0                | 0     | 0.01*      |
|                                                                            | Diabetic     | 31                | 100%  | 10                 | 83.3% | 17               | 100%  |            |
| Duration of Illness                                                        | 1-3 years    | 15                | 48.4% | 6                  | 50%   | 3                | 17.6% | 0.02*      |

|  |            |    |       |   |       |   |       |  |
|--|------------|----|-------|---|-------|---|-------|--|
|  | 4-6 years  | 12 | 38.7% | 3 | 25%   | 7 | 41.2% |  |
|  | 7-9 years  | 4  | 12.9% | 2 | 16.7% | 1 | 5.9%  |  |
|  | ≥ 10 years | 0  | 0     | 1 | 8.3%  | 6 | 35.3% |  |

Among the study participants, 58 (96.7%) were classified as diabetic and 2 (3.3%) as prediabetic based on HbA1c levels; none had normal HbA1c values. Regarding duration of illness, 24 (40.0%) had diabetes for 1–3 years, 22 (36.7%) for 4–6 years, and 7 (11.7%) each for 7–9 years and ≥10 years.

Chi-square analysis revealed a statistically significant association between HbA1c status and stage of adolescence ( $p = 0.01$ ). All participants in

the early and late adolescence groups were diabetic, whereas the two prediabetic participants were in the middle adolescence group. A significant association was also observed between duration of illness and stage of adolescence ( $p = 0.02$ ). Participants in late adolescence were more likely to have a longer duration of illness, with 35.3% having diabetes for 10 years or more, compared with none in early adolescence.

**Table 3**

| Table 3                                                              |        |         |          |          |
|----------------------------------------------------------------------|--------|---------|----------|----------|
| Distribution of the study sample based on the prevalence of Anxiety  |        |         |          |          |
| Anxiety                                                              |        | Present |          | Absent   |
| N                                                                    |        | 57      |          | 3        |
| %                                                                    |        | 95%     |          | 5%       |
| Distribution of study subjects based on the prevalence of Depression |        |         |          |          |
| Depression                                                           |        | Present |          | Absent   |
| N                                                                    |        | 9       |          | 51       |
| %                                                                    |        | 15%     |          | 85%      |
| Distribution of the study sample based on the severity of Anxiety    |        |         |          |          |
| Anxiety status                                                       | Absent | Mild    | Moderate | Severe   |
| N                                                                    | 3      | 57      | 0        | 0        |
| %                                                                    | 5%     | 95%     | 0        | 0        |
| Distribution of study subjects based on the Severity of Depression   |        |         |          |          |
| Depression                                                           |        | Normal  | Mild     | Moderate |
| N                                                                    |        | 51      | 7        | 2        |
| %                                                                    |        | 85%     | 11.7%    | 3.3%     |

The assessment of anxiety revealed that 57 participants (95.0%) experienced symptoms of anxiety, whereas only 3 participants (5.0%) did not exhibit any symptoms. Regarding severity, 57 participants (95.0%) displayed mild anxiety, and 3 participants (5.0%) showed no signs of anxiety; there were no cases of moderate or severe anxiety. Depression was present in 9 participants (15.0%),

while 51 participants (85.0%) exhibited no signs of depression. Concerning severity, 51 participants (85.0%) had normal depression scores, 7 participants (11.7%) exhibited mild depression, and 2 participants (3.3%) experienced moderate depression. No instances of severe depression were identified.

**Table 4: Descriptive Statistics of Primary Outcome Variables**

| Parameters | Mean | SD   | Min | Max |
|------------|------|------|-----|-----|
| HbA1C      | 9.74 | 2.27 | 6   | 17  |
| HAM-A      | 6.02 | 4.35 | 0   | 17  |
| HAM-D      | 5.53 | 3.69 | 0   | 17  |

The mean HbA1c level among study participants was  $9.74 \pm 2.27\%$ , ranging from 6% to 17%. The mean anxiety score (HAM-A) was  $6.02 \pm 4.35$ , ranging from 0 to 17. Similarly, the mean depression score (HAM-D) was  $5.53 \pm 3.69$ , also

ranging from 0 to 17. These findings indicate poor overall glycemic control in the study population, while anxiety and depression scores were generally within the mild range.

**Table 5: Correlation between HbA1c, Anxiety (HAM-A), and Depression (HAM-D)**

| Parameters | Values   | HbA1c | HAM-A   | HAM-D   |
|------------|----------|-------|---------|---------|
| HbA1c      | rho      | 1     | -0.05   | -0.01   |
|            | P- Value | .     | 0.72    | 0.95    |
| HAM-A      | rho      | -0.05 | 1       | 0.91    |
|            | P- Value | 0.72  | .       | <0.001* |
| HAM-D      | rho      | -0.01 | 0.91    | 1       |
|            | P- Value | 0.95  | <0.001* | .       |

Spearman's correlation analysis was conducted to assess relationships among HbA1c levels, anxiety severity (HAM-A), and depression severity (HAM-

D). HbA1c showed no significant correlation with HAM-A scores ( $p = -0.05$ ,  $p = 0.72$ ) or with HAM-D scores ( $p = -0.01$ ,  $p = 0.95$ ). By contrast, HAM-A

and HAM-D scores were very strongly positively correlated ( $\rho = 0.91$ ,  $p < 0.001$ ), indicating that higher anxiety levels were strongly associated with higher depression levels. These findings suggest that although anxiety and depression are closely related, neither was significantly associated with glycemic control, as measured by HbA1c, in the study population.

## DISCUSSION

The current study evaluated the prevalence and severity of anxiety and depression among adolescents diagnosed with Type 1 Diabetes Mellitus (T1DM) and investigated their relationship with glycemic control. The results indicated a high prevalence of anxiety symptoms, a comparatively lower prevalence of depressive symptoms, inadequate overall glycemic management, and a robust positive correlation between anxiety and depression scores. Nonetheless, neither anxiety nor depression demonstrated a significant association with HbA1c levels.

The average age of participants in the current study was  $14.87 \pm 2.56$  years, with most falling within the early adolescent phase. Adolescence constitutes a pivotal developmental stage marked by biological, psychological, and social transformations that can complicate diabetes management. Bombaci et al. (2024) indicated that adolescents with Type 1 Diabetes Mellitus (T1DM) encounter distinct challenges concerning self-management, peer relationships, and burgeoning independence, which may predispose them to psychological distress (9). Similarly, Adal et al. (2015) highlighted that the psychosocial burden of living with T1DM during adolescence can negatively influence emotional well-being and disease management.<sup>[10]</sup>

A principal finding of this study was that 95% of participants exhibited symptoms of anxiety, although all cases were classified as mild anxiety. This observation aligns with existing literature indicating a higher prevalence of anxiety among adolescents with T1DM. In a systematic review and meta-analysis, Buchberger et al. (2016) reported significantly elevated levels of anxiety symptoms among children and adolescents with T1DM compared to healthy controls.<sup>[6]</sup> Similarly, Herzer and Hood (2010) noted that anxiety in adolescents with T1DM is frequently associated with fear of hypoglycemia, concerns regarding long-term complications, social acceptance, and the ongoing demands of diabetes self-care.<sup>[11]</sup> The notable prevalence of mild anxiety identified in this study may thus reflect the persistent psychological burden linked to diabetes management.

Depressive symptoms were identified in 15% of participants, with most cases mild. Although this prevalence is lower than that reported in several international studies, it still highlights psychological vulnerability among adolescents with T1DM.

Nguyen et al. (2021), in a systematic review, found that the prevalence of depressive symptoms among adolescents with T1DM ranged from 10% to 30%, depending on the assessment method used.<sup>[12]</sup> Similarly, Buchberger et al. (2016) demonstrated that depressive symptoms occur more frequently in adolescents with T1DM than in the general population.<sup>[6]</sup> The relatively lower prevalence observed in the present study may be attributable to cultural differences, strong family support systems, variations in assessment tools, or characteristics specific to the study population.

The average HbA1c in this study was  $9.74 \pm 2.27\%$ , indicating suboptimal glycemic control among participants. This result is consistent with earlier research showing challenges in meeting glycemic goals during adolescence. Bombaci et al. (2024) identified hormonal fluctuations, risk-taking behaviours, inconsistent treatment adherence, and psychosocial stressors as factors contributing to poor glycemic control in adolescents with T1DM.<sup>[9]</sup> The high mean HbA1c level highlights that achieving optimal metabolic control remains a major challenge for this age group.

Despite inadequate glycemic control, the current investigation found no statistically significant correlation between HbA1c levels and anxiety scores ( $\rho = -0.05$ ,  $p = 0.72$ ) or depression scores ( $\rho = -0.01$ ,  $p = 0.95$ ). These results diverge from those reported in several prior studies. Goncerz et al. (2023) observed that adolescents exhibiting higher depressive symptoms tended to have poorer glycemic control and elevated HbA1c levels.<sup>[13]</sup> Similarly, Malkawi et al. (2025), in their systematic review, concluded that anxiety and depression are often associated with unfavourable glycemic outcomes and decreased adherence to diabetes management protocols.<sup>[14]</sup> Herzer and Hood (2010) also proposed that psychological distress may impede self-care behaviours such as blood glucose monitoring, insulin administration, and dietary adherence, thereby contributing to inferior glycemic control.<sup>[11]</sup>

The absence of an observed association in the present study may be attributed to several factors. Firstly, the relatively small sample size may have limited the statistical power to detect subtle relationships. Secondly, the majority of participants demonstrated only mild levels of anxiety and depression, which may not have been sufficiently severe to exert a significant impact on diabetes self-management behaviours. Thirdly, glycemic control is influenced by multiple determinants, including insulin adherence, family support, socioeconomic status, and healthcare access, which may exert a greater impact on HbA1c levels than mild psychological symptoms alone. Similar findings have been reported by de Wit et al. (2007), who concluded that emotional problems are not invariably independently associated with glycemic control after adjusting for other psychosocial and clinical factors.<sup>[15]</sup>



One of the most significant findings of the current study was the very strong positive correlation between anxiety and depression scores ( $p = 0.91$ ,  $p < 0.001$ ). This outcome aligns with existing literature demonstrating considerable overlap between anxiety and depressive symptoms in adolescents with chronic illnesses. Buchberger et al. (2016) reported that anxiety and depression frequently coexist in youth with T1DM and may share common psychosocial risk factors.<sup>[6]</sup> Nguyen et al. (2021) similarly observed that adolescents experiencing anxiety symptoms are at an increased risk of developing depressive symptoms, and vice versa.<sup>[12]</sup> The robust association identified in this study underscores the importance of evaluating both conditions concurrently during routine diabetes management.

The study also demonstrated significant associations between the stage of adolescence and both HbA1c levels and illness duration. Late adolescents were more likely to have a longer duration of diabetes than younger participants. This finding is anticipated because advancing age is naturally associated with longer disease duration. Previous research by Bombaci et al. (2024) has indicated that older adolescents frequently encounter escalating challenges related to self-management, transition to adult care, and treatment adherence, which may impact both psychological well-being and metabolic outcomes.<sup>[9]</sup>

Overall, the findings of this study substantiate existing evidence that anxiety and depression are significant psychological concerns among adolescents with T1DM. Consistent with the findings of Buchberger et al. (2016), Herzer and Hood (2010), and Nguyen et al. (2021), this study underscores the considerable psychological burden experienced by adolescents living with diabetes.<sup>[6,11,12]</sup> Although no significant correlation was observed between psychological symptoms and glycemic control, the high prevalence of anxiety and the strong association between anxiety and depression highlight the necessity for routine psychological screening and integrated psychosocial support as components of comprehensive diabetes management. Early detection and intervention may enhance emotional well-being, treatment adherence, quality of life, and long-term health outcomes among adolescents with T1DM.

## CONCLUSION

This study identified that adolescents with Type 1 Diabetes Mellitus encounter significant psychological difficulties, notably high levels of anxiety and depression. Although their glycemic control was generally poor, as shown by elevated HbA1c levels, no direct connection was found between blood sugar levels and either anxiety or depression. However, a strong positive correlation was observed between anxiety and depression,

indicating these issues frequently co-occur in teens with T1DM. The research also pointed to relationships among the stage of adolescence, HbA1c levels, and illness duration, suggesting that developmental and disease-related factors influence outcomes. These findings emphasise the importance of routine psychological screening and psychosocial support within comprehensive diabetes management. Early recognition and intervention for anxiety and depression could enhance emotional well-being, improve adherence to treatment, and boost quality of life for teens with T1DM. Additional research involving larger sample sizes and longitudinal designs is essential to deepen understanding of the complex links between mental health and blood sugar control in this group.

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