



Mental and Social Health Status and its Association With Glycosylated Hemoglobin Level in Adolescents Aged 12-18 Years With Type 1 Diabetes

Mahtab Ordooei^{1,2*}, Zahra Niknafs³, Akram Mehrabbeik², Nasim Namirani^{2*}

¹Hematology and Oncology Research Centre, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

²Diabetes Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

³Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

Abstract

Background: Chronic diseases such as diabetes have significant effects on the mental and social health of patients. The aim of this study was to investigate the mental and social health status of children with type 1 diabetes mellitus (T1DM).

Materials and Methods: This cross-sectional study was conducted on 52 T1 diabetic patients aged 12-18 years who referred to Yazd Diabetes Center in 2020. The patients were selected by simple random sampling. The data collection tool was the Pediatric Symptom Checklist (PSC) questionnaire, which contained 35 three-choice psychological questions about mental health. Data were analyzed using SPSS 22.

Results: Totally, 31 (56.9%) and 21 (40.4%) of patients were males and females, respectively. The mean age of the subjects was 15.23 (± 2) and the mean duration of diabetes was 6.19 (± 3.56) years. Moreover, 48.1% of patients had a positive family history of diabetes. The mean of hemoglobin A1c (HbA1c) was 8.05 (± 1.62) and the mean of HbA1c in patients with psychosocial disorders was 8.74 (± 0.08), which was significantly higher than that of subjects without psychosocial disorders ($P=0.032$).

Conclusion: T1DM patients, whose blood sugar was not controlled, reported more mental health problems, thus it is essential to apply psychosocial health promotion strategies to these adolescents and their families.

Keywords: Adolescents, Glycosylated hemoglobin, Mental health, Type 1 diabetes

*Correspondence to

Nasim Namirani,
Diabetes Research Center,
Shahid Sadoughi University
of Medical Sciences, Yazd,
Iran.
Tel: +983537280226,
Email: namirani.nasim@
gmail.com



Received: January 9, 2022, Accepted: February 1, 2022, ePublished: April 1, 2022

Introduction

Type 1 diabetes mellitus (T1DM) is the most common endocrine disease among children (1,2). Its prevalence is 5%-15% of diabetic patients and it approximately affects 500 000 children under 15 worldwide. In 90% of cases, this condition is related to the destruction of insulin-producing β cells, and in other cases, it is associated with idiopathic causes (1).

It is well recognized that T1DM causes an increased risk of microvascular and macrovascular complications (2). Moreover, it is associated with stress, has negative psychological effects in addition to physical adverse effects (3).

Diabetic patients are at greater risk of developing psychiatric disorders, including depression, anxiety, eating disorders, as well as obesity, anorexia nervosa, and sleep disorders compared to the general population (4). Although psychiatric disorders such as depression and anxiety are usually detected in children with T1DM,

psychosocial intervention is not routinely offered to them (5). Additionally, limited papers in Iran have evaluated psychosocial status in children with T1DM (6).

To promote optimal medical outcomes, the management of diabetic children is essential. Some studies showed a significant positive association between poor control of diabetes and anxious life events, and this is a threat to the mental health of these patients (4, 7, 8). It was specified that behavioral problems lead to poor blood sugar control in T1DM patients (9). Thus, patient-centered psychosocial care requires exploring related-risk factors in diabetic patients (10). On the other hand, poor mental health can deteriorate the T1DM control (11). Managing diabetes in children and adolescents poses an additional challenge in terms of mental health (3).

Although diabetes management, in addition to metabolic goals, facilitates normal and emotional development, the importance of mental and social health aspects of these children are not considered due to the

emphasis on maintaining normal glucose levels in these patients. Therefore, this study aimed to evaluate the mental and social health status of adolescents aged 12-18 years with T1DM and its correlation with the hemoglobin A1c (HbA1c) level.

Materials and Methods

This analytical cross-sectional study was performed on children who had been diagnosed with T1DM by an endocrinologist and referred to the Yazd diabetes research center. Using the following formula and considering a 95% confidence level, 80% power, $P=20\%$ (mental health disorder prevalence based on previous studies), and $d=10\%$, 50 subjects were selected by simple random sampling (with the random number table).

$$n = \frac{Z_{1-\frac{\alpha}{2}} P(1-P)}{d^2}$$

The inclusion criteria consisted of being in the age range of 12-18 years and diagnosed with T1DM for at least three months, being under medical treatment, and having the consent to participate in the study. On the other hand, the exclusion criteria were parental dissatisfaction, other chronic diseases, the history of severe mental disorders such as psychosis, and consumption of psychiatric drugs for the past year. In addition, participants were excluded from the study if they missed more than four questions or did not report their HbA1c in the questionnaire.

The data collection tool was the standard Pediatric Symptom Checklist (PSC), which was completed by the patients' mothers in a face-to-face session. PSC contains 35 three-choice psychological questions about mental health that are rated as "Never," "Sometimes," or "Often" present. Values of 0, 1, and 2 are assigned to "Never," "Sometimes," and "Often," respectively.

If one to three questions are not answered, those questions get a score of zero, but if four questions or more are unanswered, the questionnaire is invalid. People with a score of ≤ 27 have normal performance, while those with a score of $28 \leq$ have mental problems. Screening school-age children indicated that the PSC has a specificity of 0.68 and a sensitivity of 0.95 (12). Jellinek et al reported the reliability of the questionnaire in terms of Cronbach's alpha from 0.84 to 0.91 (13, 14). The validity and reliability of this questionnaire among the Iranian population were confirmed by Rasekhinejad (15). The mean of the last two HbA1c levels was considered as HbA1c, and values ≥ 7 were considered as a poor control.

Quantitative variables included age, mental health score, HbA1c score, and duration of diabetes, while qualitative variables were gender and mental health status. Data analysis was performed by SPSS, version 22. The chi-square test was used to determine the relationship between qualitative variables. Further, an independent t-test was applied to compare the means of the HbA1c score and

duration of diabetes between groups. Furthermore, the Pearson correlation test was employed to investigate the relationship between mental health status and HbA1c.

Results

In general, 52 T1DM individuals participated in this study, and the distribution of variables was normal. Among participants, 31 (56.9%) and 21 (40.4%) cases were males and females, respectively. The mean age of subjects was $15.23 (\pm 2)$ and the mean duration of diabetes was 6.19 years. Moreover, 48.1% of them had a positive family history of diabetes. The average of subjects' HbA1c was $8.05 (\pm 1.62)$. Based on HbA1c, 21.2% and 78.8% of patients had controlled and uncontrolled blood sugar, respectively. The prevalence of mental and social health disorders was 25% (12 patients). The related results are presented in Table 1.

Based on data in Table 2, 63.6% of patients with mental disorders were girls and 36.4% of them were boys. However, based on the chi-square test, this difference was not statistically significant ($P=0.250$).

Table 1. Frequency of Participants' Demographic and Disease-Related Variables

Variables	Mean (\pm SD)	No. (%)
Age (y)	15.23 (± 2)	-
Duration of diabetes (y)	6.19 (± 3.56)	-
HbA1c	8.05 (± 1.62)	-
Gender	Female	- 31 (59.6%)
	Male	- 21 (40.4%)
Family history of diabetes	Yes	- 25 (48.1%)
	No	- 27 (51.9%)
Diabetes status	Control	- 11 (21.2%)
	Poor control	- 41 (78.8%)
Mental and social health status	Normal	- 40 (75%)
	Psychosocial disorders	- 12 (25%)

Note. SD: Standard deviation.

Table 2. Participants' Characteristics According to Mental and Social Health Status

Variables	Disorder in Mental and Social Health Status		P Value
	Yes	No	
Gender			
Female	7 (63.6%)	22 (56.4%)	0.25*
Male	5 (36.4%)	18 (43.6%)	
Positive family history			
Yes	4 (36.4%)	21 (53.8%)	0.16*
No	8 (63.6%)	19 (46.2%)	
Duration of diabetes (years) Mean (\pm SD)	6.38 (4.04)	6.17 (3.54)	0.86**
HbA1c Mean (\pm SD)	8.74 (0.89)	7.76 (1.67)	0.03**

Note. SD: Standard deviation; *Chi-square test; **Independent sample t-test.

According to the findings, 36.4% of patients with psychosocial disorders had a history of diabetes in the family, while 63.6% of them had no history of diabetes in their family. Therefore, there was no significant relationship between the patients' psychosocial disorders and their family history of diabetes ($P=0.163$).

The mean duration of diabetes in adolescents with and without psychosocial disorders was 6.38 and 6.17 years, respectively, which was not statistically significant ($P=0.86$). The mean of HbA1c in patients with psychosocial disorders was 8.74, which was significantly higher compared to subjects without psychosocial disorders ($P=0.032$).

According to the Pearson correlation test, there was a positive and significant correlation between HbA1c and the mental health questionnaire scores ($r=0.323$, $P=0.030$).

Discussion

The findings of the present study showed that there was no gender difference in the prevalence of psychosocial disorders among participants. In line with the results of our study, Khandelwal et al found that the prevalence of psychiatric diseases in T1DM children is the same between both genders (16). In contrast, the results of a meta-analysis of 20 studies revealed that in youth with T1DM, females were at a higher risk of anxiety than males (17). Wisting et al (18) and Mirzaei also achieved similar results in their studies, indicating that the disorder was more common in women than men. The incompatibility of the results of our study with other studies may be due to the small sample size in the present study. The results of the independent sample t-test indicated that the mean of HbA1c in adolescents with mental health disorders was higher than that of those without mental health disorders, and this difference was statistically significant.

The relationship between mental and social health status and blood sugar control in diabetic patients has been proven in several studies. Wisting et al demonstrated that poor blood sugar control among diabetic girls was associated with a negative attitude toward the consequences of the disease and an inability to control it (19). In another study conducted on 100 T1DM individuals, Ahola et al concluded that blood glucose concentrations were significantly different (6.5 mmol/L vs. 8.4 mmol/L) in low and high perceived stress groups (20). Similarly, Buchberger et al performed a systematic review and meta-analysis of 14 studies regarding the symptoms of depression and anxiety in T1DM youth and found that there were correlations among the symptoms of depression and anxiety and glycemic control, as well as between HbA1c, diabetes-specific stress, and depression (21).

According to the results of the Pearson correlation test, there was a positive and significant correlation between the amount of HbA1c and the mental health questionnaire

scores in the present study. In other words, patients' HA1c levels increased by increasing scores obtained from PSC, which is in line with the results of a survey conducted by Seo et al, indicating that low concentrations of HbA1c were associated with lower anxiety, greater satisfaction, and better perception of health in adolescents (22). In another study, Jaser et al (23) reported that children with poor sleep quality had poor glycemic control in comparison with children with good sleep quality (HbA1c = 7.9% [63 mmol/mol] vs. 7.6% [60 mmol/mol]).

In other words, in T1DM people, depression and anxiety had a negative impact on the treatment process, ultimately leading to poor management of diabetes (24). In fact, most T1DM patients do not reach the optimal level of blood sugar control because they have not accepted their medical condition psychologically and behaviorally, and this is a point that has received no attention (25).

Limitations

The limitation of the present study was selecting the samples from only one government referral center, which may have affected the generalizability of the results.

Conclusion

The findings revealed that T1DM children with more social and mental health problems had poor control of the HbA1c level (as one of the important indicators in the proper management of the disease). Therefore, planning for psychosocial support for these children and their families will both improve their mental health and better control their blood sugar.

Acknowledgment

The authors thank the Yazd Diabetes Center and adolescents with type 1 diabetes and their families for their cooperation in this project.

Authors' Contribution

MO, ZN, and AM: Conceptualization, original draft writing, investigation, and formal analysis; MO and NN: Conceptualization, supervision, and project administration; ZN: Conceptualization, and project administration; ZN and AM: Investigation; MO and NN: Writing including reviewing and editing, and investigation.

Conflict of Interest Disclosures

There is no conflict of interests.

Disclaimer

The views expressed here are those of the authors and do not necessarily reflect the views of the Ministry of Health and Medical Education.

Ethical Statement

This research was approved by the Ethics Committee of Yazd University of Medical Sciences (IR.SSU.MEDICINE.RWC.1399.063).

Funding/Support

There was no funding.

References

1. Meneghini L. Insulin-dependent diabetes mellitus (IDDM). In: Gellman MD, ed. *Encyclopedia of Behavioral Medicine*. Cham: Springer; 2020. p. 1202-3. doi: [10.1007/978-3-030-39903-0_1195](https://doi.org/10.1007/978-3-030-39903-0_1195).
2. Bhattarai S, Godsland IF, Misra S, Johnston DG, Oliver N. Metabolic health and vascular complications in type 1 diabetes. *J Diabetes Complications*. 2019;33(9):634-40. doi: [10.1016/j.jdiacomp.2019.05.026](https://doi.org/10.1016/j.jdiacomp.2019.05.026).
3. Dybdal D, Tolstrup JS, Sildorf SM, et al. Increasing risk of psychiatric morbidity after childhood onset type 1 diabetes: a population-based cohort study. *Diabetologia*. 2018;61(4):831-838. doi: [10.1007/s00125-017-4517-7](https://doi.org/10.1007/s00125-017-4517-7)
4. Sharif K, Wataf A, Coplan L, Amital H, Shoenfeld Y, Afek A. Psychological stress and type 1 diabetes mellitus: what is the link? *Expert Rev Clin Immunol*. 2018;14(12):1081-8. doi: [10.1080/1744666x.2018.1538787](https://doi.org/10.1080/1744666x.2018.1538787).
5. Grey M, Cameron ME, Lipman TH, Thurber FW. Psychosocial status of children with diabetes in the first 2 years after diagnosis. *Diabetes Care*. 1995;18(10):1330-6. doi: [10.2337/diacare.18.10.1330](https://doi.org/10.2337/diacare.18.10.1330).
6. Amiri S, Saki F, Seif M, Mirahmadizadeh A. Prevalence and incidence of insulin dependent diabetes mellitus (IDDM) in Fars province in the South of Iran, 2016-17: an insurance archived-prescription-based study. *Journal of Health Sciences & Surveillance System*. 2021;9(2):81-8. doi: [10.30476/jhsss.2020.88309.1143](https://doi.org/10.30476/jhsss.2020.88309.1143).
7. Sharma JK, Rohatgi A, Sharma D. Diabetic autonomic neuropathy: a clinical update. *J R Coll Physicians Edinb*. 2020;50(3):269-73. doi: [10.4997/jrcpe.2020.310](https://doi.org/10.4997/jrcpe.2020.310).
8. Ghaemi N, Hasanabadi H, Ashrafzadeh F, Sarvari S, Rahimi H, Hashemian S. Peripheral neuropathy in children and adolescents with insulin-dependent diabetes mellitus. *Iran J Child Neurol*. 2018;12(2):83-90.
9. Alazawi Z, Alqudah O, Al-Bashaireh A. Depression, anxiety and sexual dysfunction among Jordanian women with type 2 diabetes mellitus. *Acta Med Iran*. 2020;58(2):56-63. doi: [10.18502/acta.v58i2.3710](https://doi.org/10.18502/acta.v58i2.3710).
10. Young-Hyman D, de Groot M, Hill-Briggs F, Gonzalez JS, Hood K, Peyrot M. Psychosocial care for people with diabetes: a position statement of the American Diabetes Association. *Diabetes Care*. 2016;39(12):2126-40. doi: [10.2337/dc16-2053](https://doi.org/10.2337/dc16-2053).
11. AlKhathami AD, Alamin MA, Alqahtani AM, Alsaed WY, AlKhathami MA, Al-Dhafaeri AH. Depression and anxiety among hypertensive and diabetic primary health care patients. Could patients' perception of their diseases control be used as a screening tool? *Saudi Med J*. 2017;38(6):621-8. doi: [10.15537/smj.2017.6.17941](https://doi.org/10.15537/smj.2017.6.17941).
12. Jellinek MS, Murphy JM, Robinson J, Feins A, Lamb S, Fenton T. Pediatric Symptom Checklist: screening school-age children for psychosocial dysfunction. *J Pediatr*. 1988;112(2):201-9. doi: [10.1016/s0022-3476\(88\)80056-8](https://doi.org/10.1016/s0022-3476(88)80056-8).
13. Jellinek MS, Murphy JM, Burns BJ. Brief psychosocial screening in outpatient pediatric practice. *J Pediatr*. 1986;109(2):371-8. doi: [10.1016/s0022-3476\(86\)80408-5](https://doi.org/10.1016/s0022-3476(86)80408-5).
14. Jellinek MS, Murphy JM. Screening for psychosocial disorders in pediatric practice. *Am J Dis Child*. 1988;142(11):1153-7. doi: [10.1001/archpedi.1988.02150110031013](https://doi.org/10.1001/archpedi.1988.02150110031013).
15. Rasekhinejad H. Comparison the Psychosocial Health of Children (6-12) of Physician, Dentist, Pharmacist and Housewife of Yazd City [dissertation]. Yazd, Iran: Shahid Sadoughi University of Medical Sciences; 2012. [Persian].
16. Khandelwal S, Sengar GS, Sharma M, Choudhary S, Nagaraj N. Psychosocial illness in children with type 1 diabetes mellitus: prevalence, pattern and risk factors. *J Clin Diagn Res*. 2016;10(9):SC05-SC8. doi: [10.7860/jcdr/2016/21666.8549](https://doi.org/10.7860/jcdr/2016/21666.8549).
17. Rechenberg K, Whittemore R, Grey M. Anxiety in youth with type 1 diabetes. *J Pediatr Nurs*. 2017;32:64-71. doi: [10.1016/j.pedn.2016.08.007](https://doi.org/10.1016/j.pedn.2016.08.007).
18. Wisting L, Skriverhaug T, Dahl-Jørgensen K, Rø Ø. Prevalence of disturbed eating behavior and associated symptoms of anxiety and depression among adult males and females with type 1 diabetes. *J Eat Disord*. 2018;6:28. doi: [10.1186/s40337-018-0209-z](https://doi.org/10.1186/s40337-018-0209-z).
19. Wisting L, Bang L, Natvig H, Skriverhaug T, Dahl-Jørgensen K, Lask B, et al. Metabolic control and illness perceptions in adolescents with type 1 diabetes. *J Diabetes Res*. 2016;2016:3486094. doi: [10.1155/2016/3486094](https://doi.org/10.1155/2016/3486094).
20. Ahola AJ, Forsblom C, Harjutsalo V, Groop PH. Perceived stress and adherence to the dietary recommendations and blood glucose levels in type 1 diabetes. *J Diabetes Res*. 2020;2020:3548520. doi: [10.1155/2020/3548520](https://doi.org/10.1155/2020/3548520).
21. Buchberger B, Huppertz H, Krabbe L, Lux B, Mattivi JT, Siafarikas A. Symptoms of depression and anxiety in youth with type 1 diabetes: a systematic review and meta-analysis. *Psychoneuroendocrinology*. 2016;70:70-84. doi: [10.1016/j.psyneuen.2016.04.019](https://doi.org/10.1016/j.psyneuen.2016.04.019).
22. Seo JS, Bahk WM, Wang HR, Woo YS, Park YM, Jeong JH, et al. Korean medication algorithm for depressive disorders 2017: third revision. *Clin Psychopharmacol Neurosci*. 2018;16(1):67-87. doi: [10.9758/cpn.2018.16.1.67](https://doi.org/10.9758/cpn.2018.16.1.67).
23. Jaser SS, Foster NC, Nelson BA, Kittelsrud JM, DiMeglio LA, Quinn M, et al. Sleep in children with type 1 diabetes and their parents in the T1D exchange. *Sleep Med*. 2017;39:108-15. doi: [10.1016/j.sleep.2017.07.005](https://doi.org/10.1016/j.sleep.2017.07.005).
24. Ducat L, Philipson LH, Anderson BJ. The mental health comorbidities of diabetes. *JAMA*. 2014;312(7):691-2. doi: [10.1001/jama.2014.8040](https://doi.org/10.1001/jama.2014.8040).
25. Garrett C, Ismail K. Forgotten: mental health interventions in type 1 diabetes. *Lancet*. 2020;395(10218):115. doi: [10.1016/s0140-6736\(19\)32688-1](https://doi.org/10.1016/s0140-6736(19)32688-1).