## RESEARCH



# Prevalence and associated factors of psychiatric problems in children aged 6–18 years with type-1 diabetes mellitus in Gondar, Ethiopia: a cross-sectional study



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## Abstract

**Background** Diabetes mellitus is one of the most common chronic illnesses in children with multiple psychosocial, economic and developmental effects. Psychiatric disorders such as depression, anxiety, psychological distress, and eating disorders are more common in diabetic patients than the non-diabetic once. The main objective of our study was to assess Prevalence and associated factors of psychiatric problems in children aged 6–18 years with type 1 diabetes mellitus in Gondar, Ethiopia.

**Methods** An institution-based cross-sectional study was conducted among 206 children aged 6–18 years with type-1 diabetes mellitus having regular follow-ups at the University of Gondar comprehensive and Specialized Hospital (UoGCSH) over three three-month period. Data was collected by trained physicians using interviewer-administered structured questionnaires. Convenient sampling technique was applied and Participants were selected sequentially until the sample size was achieved. Both bivariate and multivariate logistic regression analyses were used for Model fitness and the strength of association was determined using an OR, p-value of <0.05 and 95% Cl.

**Results** The prevalence of psychiatric problems was 11.7% and those children living with only either of the parent (AOR=8.39, 95%: 1.5–46), living with other relatives (AOR=11.3, 95% CI: 1.97–64.7), more than 5 family size (AOR=0.3, 95%CI: 0.1–1.2), fathers attended formal education (AOR=0.3, 95%: 0.04–1.73), a patient having good glycemic control (AOR=0.2, 95%: 0.04–0.67) and those with a family history of diabetes mellitus(AOR=5.2, 95% CI: 1.2–22.1) were significantly associated with a psychiatric problem in diabetic aged 6–18 years with *p*-value < 0.05.

**Conclusion** The prevalence of psychiatric problems in diabetic children was significantly high and children living with single parent, paternal educational status, glycemic control, family history of diabetes, and family size were found to have significant association with the occurrence of psychiatric problems in diabetic children.

Keywords Psychiatric problems, Children, Type 1 diabetes mellitus, Gondar SDQ

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## Background

Type 1 diabetes mellitus is one of the most common chronic metabolic disorders in children having lifelong treatment and different complications. Presentations of Type-1diabetes in children have bimodal age of distribution (around school age and at the time of puberty) [1, 2].The SEARCH for Diabetes in Youth (SEARCH) study conducted for 9 years revealed a significant rise of Type-1 DM in children below 19 years of age [3]. According to the International Diabetes Federation (IDF) study done in 2021, the estimated prevalence of T1DM among Ethiopian children and adolescents below the age of 19years was 2.4 per 100,000 per year [4] and another single institution based registry showed that the magnitude of childhood diabetes in Ethiopia was 7.4% [5].

Children with type-1diabetes mellitus face many stressors and challenges as a result of their chronic illnesses, the need for daily administration of insulin, and management of complex medical conditions which require daily completion of multiple self-care behaviors which imposes problems of the diabetic child on social interactions with family members, peers, and teachers, and the interference of daily activities due to symptoms of diabetes and complications like hypoglycemia [6]. Diabetic children struggle to cope with diabetes in the early stages with frequent experiences of feelings of sadness, withdrawal, and anxiety. More than 1/3rd of children develops one of the psychiatric disorders in the 1st decade after the onset of diabetes. The commonest psychiatric disorders are depression; anxiety and behavioral disorders. Disturbed eating behaviors are common in girls which include bulimia nervosa binge eating disorder and rarely anorexia nervosa [7].

A case-control study conducted on children with type-1 diabetes showed 19% higher rate of mental health problems and a 17% lower school performance after 12 years of diabetic diagnosis [8]. Another meta-analysis reported that children with diabetes were more likely to develop a variety of psychological problems than their healthy classmates so assessment and appropriate management of psychosocial issues are important throughout the life span of individuals with type-1diabetes [6, 9]. Reports from Sweden and Germany revealed that the prevalence of psychiatric disorders in diabetic children was 8.3% and 33.3%, respectively [10, 11]. Another casecontrol study also reported that the prevalence of psychiatric disorders in diabetic children was higher than in non-diabetic children (22.2% vs. 9%) [12].

Even though; the burden of psychiatric disorders in diabetic children is significant, evidence is scarce in Ethiopian diabetic children for which we strongly believe that our study will have contributions in the clinical practice, used as an eye-opener and baseline evidence for other researchers in the area.

## **Methods and materials**

## Study design, period and setting

A cross-sectional study was conducted over 3-months period (from February 1st -April 30th, 2022) at the pediatric diabetic follow-up clinic of the University of Gondar Comprehensive Specialized Hospital (UOGCSH), Gondar, Northern Ethiopia, which is located 765 km northwest of Addis Ababa, the capital city of Ethiopia. It officially commenced its function in 1954 and currently, it is serving as a tertiary teaching hospital for more than 10 million populations. In the hospital, there is a strong Pediatric service having both inpatient and outpatient care and a chronic follow-up unit for different problems including pediatric endocrinology, cardiology, Nephrology, Nutrition l, high-risk infant, and neurology clinics. Currently, there are a total of 345 children with type-1 DM having follow up at the pediatric endocrine clinic. The medical service is being delivered daily by Medical interns, Pediatric residents, and general pediatricians along with the nursing staff.

## Sample size and sampling procedure

The sample size was calculated using single population proportion formula by considering the following assumption, 90% confidence interval, 5% margin of error and 22% proportion of Psychiatric disorders in adolescents with type 1 diabetes from a previous case-control study conducted in Brazil [12].

- $N = Z^{2*}P(1-p)/e^2$ .
- $N = (1.64)^2 \times 0.22 (1 0.22) / (0.05)^2 = 187.$
- By adding 10% non-respondents rate the final sample size was 206.

The study participants were selected by convenient sampling technique by which participants were included sequentially until the sample size was achieved among children aged 6-18years with type-1 DM.

## Instrument and data collection technique

After getting informed consent or assent from primary caregivers; data were collected by trained physicians using an interviewer-administered structured questionnaire. Data collectors were trained for 3 days about the tool and a pretest was done on adult diabetic patients in the same hospital, quality control was assured during the process by the supervisor and timely correction was done daily. The data collection tool (questionnaire) contains socio-demographic characteristics and medical-related questions which were developed from different literature. The questionnaire also included SDQ questions for mental health problems and the total difficulty Score was generated through the addition of 4 of the 5 subscales or summary scores that make up the first 25 items of the SDQ. These sub-scale scores were calculated only if at least 3 of the 5 items have been completed. If less than 3 were completed, the sub-scale score was considered as missing. It was simpler to score all five sub-scales before working out the Total Difficulty Score. Total difficulties score>14, Emotional Symptoms Score>4, Conduct Problem Score>3, Hyperactivity Score>6, Peer Problem Score>3, and Prosocial Behavior Score<5 showed mental health problems. The eating disorder was assessed using the SCOFF (Sick, Control, One, Fat, Food) screening tool and the score of 2 and above were included as having psychiatric problem together with the SDQ tool [16, 17].

### Data analysis

Data were first entered into Epi Data V.4.6 and then exported it to STATA version 15.1 for cleaning and analysis after it was double-checked for consistency and completeness. Frequencies, Percentages, mean and standard deviations were used to summarize descriptive statistics and tables and figures were used for data presentation. To identify factors associated with the psychiatric disorders among T1 DM patients; first bivariate analysis was done on each independent variable with the dependent variable. Those variables which had an association in bivariate logistic regression analysis with p-value<0.25 were included in the backward step multivariate logistic regression analysis. The strength of association was determined using an odds ratio and 95% confidence level. Statistical significance was stated at a P value of <0.05. The final multivariable logistic regression method was checked for Model fitness using Hosmer-Lemeshow goodness of fit method (p=.08) which was adequate.

## **Operational Definitions**

**Glycemic control** fasting glucose level (FBS) or Random blood glucose (RBS) was used.

**Well-controlled** FBS level: 70-126 mg/dl or RBS 70–200 mg/dl.

**Poor glycemic control** FBS level<70 or >126 mg/dl or RBS<70 or >200 mg/dl.

Adolescents age 10–18 years old.

**Common psychiatric problems** Emotional problems, prosocial problems, Peer problem, conduct problem, hyperactivity problem, and eating disorder.

## Results

## Sociodemographic characteristics of participants

A total of 206 children with type DM were included in the study with the mean age of 12.8yrsand SD of  $\pm$  3.2and the minimum and maximum age of participants were 6yrs and 18yrs, respectively. Majority (75.2%) of participants were adolescents aged 10-18yrs. Males were a little bit higher (51.9%) than females (48.1%). Nearly 78% of participants were attending school and majority (60.2%) of children was from rural area. Majority (81.6%) of children were living with both parents and the remaining 11.7% and 6.8% were living with one parent and other family member, respectively. Most of the mothers (72.8%) and fathers (62.6%) didn't attend formal education (Table 1).

## **Clinical characteristics of participants**

The mean age at first diagnosis of diabetes mellitus was 7.9rs with SD of  $\pm$  3.4yrs. More than 1/3rd (37.4%) of children were diagnosed to have type-1 DM in the age range of 6-9yrs.

The median follow-up time of the participants with diabetes was  $4.8\pm2.6$  years with an interquartile range of 3–6 years. A majority (69.4%) of children were injecting insulin by themselves and most (64.1%) of them were having good glycemic control. Among those children with poor glycemic control; 81% of them were adolescents. Twenty 60% of children were admitted to hospitals in the last 1-year because of DKA. Positive family history of diabetes was identified in 15.5% of participants (Table 2).

## The magnitude of common psychiatric disorders among diabetic children

Using SDQ and SCOFF screening tools psychiatric problems were assessed and the mean screening score of **Eating disorders screening instruments (SCOFF) score was 0.30(±0.6) and the Total SDQ score was 4.3(±3.9).** Among the 206 participants; 8 (3.88%) children had a total Emotional score  $\geq$ 5, 5(2.43%) had a total conduct score  $\geq$ 4, 4 (1.9%) had a total hyperactivity score  $\geq$ 7, 6(2.9%) had Peer problem score  $\geq$ 4, 7 (3.4%) had prosocial score  $\leq$ 4, 5 (2.4%) had SCOFF  $\geq$ 2 and 9 (4.4%) had total SDQ score  $\geq$ 15.

Overall prevalence of psychiatric problems among children with type-1 diabetes mellitus was 11.7% (24/206) (Fig. 1).

## Factors Associated with psychiatric problems in the study participants

Based on the bi-variable logistic regression analysis family setting, family size, father attended formal education, family income, glycemic control, who injects the insulin and family history of DM were associated with psychiatric disorders in children with type-1 DM with *p*-value < 0.25. However, the multivariable logistic regression analysis identified that children living with only either of the parent (AOR=8.39, 95%: 1.5–46), living with other relatives (AOR=11.3, 95% CI: 1.97–64.7), more

Table 1	Socio-demographic	characteristics of c	hildren aged 6–18 <sup>,</sup>	years with type 1	diabetes ( $N = 206$ )
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Variables	Categorization	Frequency	Percent	
Age	6–9	51	24.8	
	10–18	155	75.2	
Sex	Male	107	51.9	
	Female	99	48.1	
Child level of education	Not attending school	46	22.3	
	Primary school	141	68.5	
	Secondary school	19	9.2	
Place of residence	Urban	82	39.8	
	Rural	124	60.2	
Family setting	Lives with both parents	168	81.6	
	Either mother/father	24	11.7	
	Others	14	6.8	
Family size	Family size≤4	110	53.4	
	Family size≥5	96	46.6	
Educational status of the mother	Not attending formal education	150	72.8	
	Formally educated	56	27.2	
Educational status of Father	Not attending formal education	129	62.6	
	Formally educated	77	37.3	
Occupation of the mother	Housewife	170	82.5	
	Employed(self/government)	36	17.5	
Fathers occupation	Farmer	132	64.1	
	Employed(self/government)	74	35.9	

**Table 2** Clinical characteristics of children aged 6–18 years with type 1 diabetes (N=206)

Variables	Categorization	Frequency	Percent	
Years on follow up	<5 years	109	52.9	
	≥5 years	97	47.1	
Who injects you?	Him/Herself	143	69.4	
	Parents	60	29.1	
	Others	3	1.5	
Glycemic control	Poor	74	35.9	
	Good	132	64.1	
Admitted in the last 1-yr for DKA	No	152	73.8	
	Yes	54	26.2	
Family history of diabetes	No	174	84.5	
	Yes	32	15.5	
24				



Fig. 1 Prevalence of psychiatric problems among children with type-1 diabetes mellitus

than 5 family size (AOR=0.3, 95%CI: 0.1–1.2), fathers attended formal education (AOR=0.3, 95%: 0.04–1.73), patient having good glycemic control (AOR=0.2, 95%: 0.04–0.67) and those with family history of diabetes mellitus(AOR=5.2, 95% CI: 1.2–22.1) were significantly associated with psychiatric problem in diabetic aged 6–18 years with *p*-value<0.05 (Table 3).

## Discussion

Our study showed that prevalence of psychiatric problems among children with type 1 diabetes mellitus was 11.7%. This finding was higher than a population-based case-cohort study from Sweden where the prevalence of psychiatric problems was 8.3% [10]. However, the magnitude in our study was significantly lower than reports from Germany and Sao Paulo where the prevalence of psychiatric problems among children with diabetes was to be 33.3% and 30.6%, respectively [11. 12]. These significant variations could be explained by differences in the age of included patients; the German study included those children aged 17-19 years, the sample size was 93 and they used different assessment tools which all these factors may exaggerate the magnitude of psychiatric problems. In the other study from Sao Polo; the participants were briefed about the psychiatric problems before the assessment and the sample was very small where only 45 participants were included which might led to have higher prevalence. This shows that early screening of diabetic children for psychiatric disorders is very important for early intervention.

Common psychiatric problems identified in our study by using SDQ and SCOFF screening tools were Emotional problems, Conduct Problem, Hyperactivity problem, Peer problem, Prosocial problem, and total SDQ score of 4.29 which was lower than a report from the University of North Carolina (UNC) Pediatric Diabetes Center where the screening scores revealed; total difficulties

Table 3 Bivariate and multivariate logistic regression analyses to assess associated factors (N = 206)

Variables	Category	Psychiatric disorder		COR	AOR.	<i>p</i> -value	Sig	
			Yes	No				
Family setting		Both parents	7	161	-	1		
		Either of parents	10	14	16.43(5.42–49.83)	8.39(1.53–45.88)	0.014	**
		live with other relatives	7	7	23(6.32-83.75)	11.30(1.97–64.73)	0.006	***
Family size		≤5 family members	17	93		1		
		> 5 family members	7	89	0.43(0.17-1.09)	0.29(0.07-1.20)	0.088	*
Father attended formal education		Not	14	48	0.26(0.11-0.61)	1		
		Yes	10	134		0.28(0.04-1.73)	0.169	
Family income		<=2500	18	111		1		
		> 2500	6	71	0.52(0.20-1.38)	0.16(0.03-0.79)	0.024	**
Glycemic control		Poor	19	122		1		
		Good	5	60	0.29(0.08-1.01)	0.16(0.04-0.67	0.012	**
Who injects you?		Him/herself	19	55		1		
		Parents	5	127	0.11(0.04-0.32)	1.77(0.36-8.64)	0.483	
Family history of DM		No	9	165		1		
		Yes	15	17	16.18(6.16-42.48)	5.19(1.22-22.12)	0.026	**

\*\*\*\* p<.01, \*\*\* p<.05, \* p<.1

score of  $8.79\pm2.38$ . This difference may be explained due to differences in sample size, psychosocial characteristics between the settings, level of understanding of the assessment tool and perception of what is abnormal about the social values and cultures [13].In clinical practice, identifying the types of psychiatric disorders in diabetic children is crucial for early intervention and prevention of chronic sequelae.

In our study; children with type-1 DM living with a single parent and other relatives were having significant association with the development of psychiatric problems. This finding is in line with a study from the University of South Carolina, Columbia where psychiatric problems were found to be more common in diabetic children who were living with a single parent or another guardian [14].

In our study, the risk of psychiatric problems was significantly low in diabetic children with a higher number of family size and good glycemic control. When the number of households were more than 5, the risk of developing psychiatric problems was decreased by 70% Though we couldn't find literatures; the effect of family size on the risk of psychiatric problems, this may be explained by the fact that a child living with many people at home will have more pleasant times than those with low family size which may decrease the risk.

When the patient had good glycemic control; the risk of developing psychiatric problems was decreased by 80% This report is in line with a study from Dallas, USA which showed that children with poorly controlled diabetes with recurrent episodes of hospitalization due to DKA were having significantly higher risk of psychiatric disorders in comparison with diabetic children with good control of diabetes and with no recurrent admissions (88% vs. 28%) [15]. Another study from Cincinnati College of Medicine, Ohio showed that anxiety disorders in children with type-1 DM were having a strong association with less frequent blood glucose monitoring and suboptimal glycemic control [16].

Higher risk of psychiatric disorders associated with poor glycemic control in children with type-1 DM were also reported in Egypt and the UK [17, 18]. This signifies that proper glycemic control is crucial in preventing psychiatric disorders in diabetic children.

Children with type-1 DM with educated fathers have a 70% lower risk of psychiatric problems. This finding was similar to a study done in North-West Rajasthan which revealed that the prevalence of psychiatric problems was negatively associated with the level of caregiver literacy [19]. This may be explained by the fact that as family literacy increases; the chance of understanding the illness and support may be higher.

Family history of diabetes mellitus was another factor which was having 5.1 fold risk of developing psychiatric problems in a child with type-1 DM. This finding was in contrary to a report from Egypt where diabetic children with positive family history of diabetes were less affected by emotional problems (50% vs.64.3%, P 0.04) than children with negative family history of DM [18]. This variation could be to the differences in study setting, sociodemographic factors and methodology.

In our study, some sociodemographic factors such as sex, age and family income were assessed for association but showed no significant association with the development of psychiatric problems but approximately 81% of participants with poor glycemic control were adolescents that may be explained by expected by hormonal, psychosocial and behavioral changes in these age group which may compromise adherence to recommended treatment and counseling.

## Limitations of the study

The study was conducted in a single-center and the tools were not locally-validated which the limitations of our study were.

## Conclusion

The prevalence of psychiatric problems among type-1 DM in this study was high and those children not living with both parents, fathers' level of education, glycemic control, family history of diabetes, and family size were found to have a significant association with the occurrence of the psychiatric problems.

## Recommendations

The authors recommend that routine screening of diabetic children for psychiatric problems should be done at each visit to improve and maintain good quality of life especially for those children with poor glycemic control and those with family history of diabetes mellitus. We also recommend further multicenter researches.

#### Abbreviations

ADA	American Diabetic Association
AOR	Adjusted odd ratio
BGM	Blood glucose monitoring
CES-DS	Center for Epidemiologic Studies Depression Scale
DKA	Diabetic ketoacidosis
DM	Diabetes mellitus
DSM V	Diagnostic Statistical Manual, 5th edition
ED	Emergency department
EDA	Ethiopian diabetic association
FBS	Fasting Blood Glucose
HbA1C	Hemoglobin A1C
NICU	Neonatal intensive care unit
PICU	Pediatric intensive care unit
RBS	Random blood glucose
SCOFF	Sick, Control, One, Fat, Food eating disorder screening tool
RBS	Random blood glucose
SCOFF	Sick, Control, One, Fat, Food eating disorder screening tool
SQD	Strength and Difficulty question
T1DM	Type one Diabetes mellitus
WHO	World health organization

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#### Author contributions

BAA, AGD and BFA: Involved in data collection and manuscript writing MKA and GBG: participated in data analysis and manuscript preparation.

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#### Data availability

Data is available from the corresponding author upon reasonable request.

### Declarations

### Ethical approval and consent to participate

All the methods and procedures in this study were carried out by the Declaration of Helsinki and ethical clearance was obtained from the school of medicine Ethical Review committee, University of Gondar (ref.no SOM1250/01/2022). After ethical clearance was received, all participants were informed about the purpose of the study and participated voluntarily.

#### Informed consent

was obtained verbally from each participant and for those aged below 16years, assent was secured from a parent or a legal guardian whichever is applicable. Name or any identifier of the participants was omitted from the questionnaire and only medical record number and code given to the participant for the research purpose were used to ensure confidentiality. The retrieved information was used only for the purpose of the study and stored with password locked computer.

#### **Consent for publication**

Not applicable.

#### Clinical trial number

Not applicable.

#### **Competing interests**

The authors declare no competing interests.

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