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Attention-deficit hyperkinetic disorder among children and adolescents with type 1 diabetes: a cross-sectional study

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Abstract

Background: Type 1 diabetes is a common childhood disease that is affected by and affects every aspect in the life of the child or adolescent with diabetes. Data on attention-deficit hyperkinetic disorder (ADHD) among children and adolescents with type 1 diabetes is limited. The aim of this study was to assess the prevalence of ADHD among a cross-sectional sample of 70 children and adolescents with type 1 diabetes as compared to 70 matched controls and to assess the glycemic control of included patients. For a comprehensive evaluation, assessment was done using Pediatric Symptom Checklist (PSC, the 35 item), Diagnostic and Statistical Manual of Mental Disorders—the fifth edition (DSM-5) criteria, and Conners comprehensive behavior rating scale—revised for parents/caregivers. Glycemic control of all included patients was also evaluated by HbA1c %.

Results: A screening PSC score was significantly higher for children and adolescents with type 1 diabetes than controls ($p < 0.001$). Significantly larger number of cases with type 1 diabetes fulfilled DSM-5 criteria for inattentive or hyperactive or mixed type ADHD (14.3%, 17.1% and 18.6%, respectively) as compared to controls (4.3%, 5.7%, and 7.1% respectively, $p < 0.05$). Also, a significantly larger number (more than half, 57.14%) had a Conners score above 70, and the mean scores on Conners parent rating scale were also significantly higher for children with type 1 diabetes than controls ($p < 0.001$). Most of the included patients did not achieve adequate glycemic control (47.14% of patients were in poor control and only about one fifth achieved a HbA1c < 7.5%).

Conclusion: ADHD is more common among children and adolescents with type 1 diabetes than in healthy controls. It is important to perform psychiatric evaluation of children and adolescents with type 1 diabetes especially those in poor metabolic control to assess for associated neuro-behavioral disorders such as ADHD. This is crucial to be able to properly design insulin therapy for such a group of patients who may suffer hypo- or hyper-glycemia due to inattention, forgetfulness, or hyperactivity and to properly select educational material that take the easy distractibility of ADHD patients into account as well as to be able to properly manage such cases given the extra stresses entailed in having a diagnosis of diabetes.

Keywords: Type 1 diabetes mellitus, Children and adolescents, ADHD, Psychosocial dysfunction, Glycemic control

Background

Type 1 diabetes mellitus (T1DM) is one of the most common chronic diseases of children and adolescents. Type 1 diabetes affects and is affected by every aspect of a child's life (food, exercise, psychological status). Therefore, psychological assessment and support of individuals with

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diabetes is essential for successful management of their diabetes.

Attention-deficit hyperkinetic disorder (ADHD) is one of the most common neuro-behavioral disorders of childhood. ADHD was shown to have increasing global prevalence in recent decades [1]. The core ADHD symptoms are inattention and/or hyperactivity/impulsivity. These core symptoms must cause impairment of functioning in at least two settings (academic, social or occupational) for a diagnosis of ADHD to be established [2]. ADHD has a multifactorial etiology. In most cases, it results from the additive effect of multiple genetic and environmental risk factors acting together to increase the susceptibility of the individual to develop ADHD. Besides genetic predisposition, environmental risk factors that have been associated with ADHD include maternal deprivation, growing up in a stressful environment, prenatal and perinatal factors (such as maternal smoking and alcohol use), low birth weight, premature birth, and exposure to environmental toxins (such as organophosphate pesticides, polychlorinated biphenyls, zinc, and lead) [3].

Recent research has shown that among children with type 1 diabetes, a diagnosis of neurodevelopmental disorders, primarily ADHD and intellectual disability, was associated with poor glycemic control [4]. It was even suggested that a diagnosis of ADHD should be considered in adolescents with type 1 diabetes who are in poor glycemic control [5]. In one prospective research study, increased risk of diagnosis of comorbid psychiatric disorders was reported among children and adolescents with type 1 diabetes (with a 1.5 hazard ratio for ADHD) as compared to non-diabetic controls. The highest risk of psychiatric disorders was found to occur within the first 6 months of diagnosis of T1DM, and it declined with time afterwards [6]. ADHD among children and adolescents with type 1 diabetes can have a profound effect on their diabetes management and be affected by their diabetes control.

Not every child or adolescent with type 1 diabetes is evaluated by a psychiatrist in our diabetes clinic. Therefore, in the current study, we aimed to screen for the presence of ADHD symptoms using Pediatric Symptom checklist, DSM-5 criteria, and standardized Conners parent rating scale among children and adolescents with type 1 diabetes attending the out-patient diabetes clinic and to explore their glycemic control. We compared them to a matched control group.

Methods

Study design

Our study was a cross-sectional study. It was carried out in the period between October 2019 and October 2020.

Participants

Children and adolescents with type 1 diabetes aged 6 to 16 years old were randomly recruited from the Pediatric Diabetes Clinic of Ain Shams University Children's' Hospital. These children and adolescents were randomly selected using simple random sampling from the clinic data base. Type 1 diabetes was diagnosed if the patient was not obese, had no signs of insulin resistance, no family history suggestive of MODY (monogenic or maturity onset diabetes of the young), had low C-peptide, and showed insulin dependency on the doses required for a T1DM patient. Autoantibody testing is performed at our center if any of the aforementioned criteria is not fulfilled. Patients who did not have any of the exclusion criteria were first extracted from the clinic database. Next, from those patients, a sample was randomly selected for inclusion in the study using a simple random technique by means of a random number generator software. Exclusion criteria included having any neurologic disease, developmental disorder, learning disability, hearing or visual impairment, sleep disorder, specific emotional or behavioral disorders (e.g., anxiety, depressive, oppositional defiant, and conduct disorders), thyroid disease or any other chronic illness (other than diabetes), or having a positive family history of ADHD or other psychiatric disorder. Moreover, psychiatric evaluation was not done following recent recovery from diabetic ketoacidosis.

Age and sex-matched healthy controls were recruited from the outpatient clinic of the Ain Shams University Children's' Hospital. They were either coming for their scheduled vaccinations or to follow-up their growth.

A required sample size of 70 cases with type 1 diabetes and 70 controls was calculated using the Epitools program setting to detect an alpha error at 5% and power at 80%.

Data collected and study tools

Data on history of diabetes mellitus duration, current age and age at onset of diabetes, dosage of insulin, method of insulin delivery, and HbA1c average over the 6 month-period prior to inclusion in the study were collected. Diabetes control was classified as follows: good control if HbA1c < 7.5%, borderline if HbA1c is between 7.5 and < 9%, and poor control if at or above 9%. This is based on the American Diabetes Association guidance and the International Society of Pediatric and Adolescent Diabetes (ISPAD) guideline [7] advising such higher HbA1c goal if there is lack of access to advanced insulin delivery technology and continuous glucose monitoring (CGM) for the child with diabetes [7].

Psychometric assessment for ADHD

The following assessments were used in evaluating possible ADHD diagnosis among children and adolescents with type 1 diabetes and controls:

A. Pediatric Symptom Checklist (PSC)—the Arabic validated version [8].
B. Diagnostic and Statistical Manual of Mental Disorders—the fifth edition (DSM-5) criteria. DSM-5 criteria are the standard criteria used based on the best available evidence for ADHD diagnosis [9, 10]. The Arabic validated version was used [11].
C. Conners comprehensive behavior rating scale—revised for parents/caregivers: the Arabic validated version [12].

A. Pediatric Symptom Checklist (PSC)—parent version

This is a brief, 35-item, questionnaire designed to screen for cognitive/attention, emotional, and behavioral problems in children and adolescents and is meant to provide an assessment of psychosocial functioning. Although psychosocial problems are relatively common in pediatrics, they may not be noticed by teachers, pediatricians, and even parents. Therefore, the American Academy of Pediatrics recommends psychosocial screening as a part of the annual physical assessment for all children and adolescents. Items are scored on a scale of 0, 1, and 2 as "never," "sometimes," and "often," respectively. For children aged 6 to 15, scores at or above a cutoff of 28 indicate the presence of impaired psychosocial functioning compared to most other children of the same age and the need for further professional assessment [8]. The checklist takes around 5 min to fill out. The Arabic version was used [8]. Translations were created for the California Department of Health Services, where the original PSC was developed and are available on their website [8].

B. DSM-5 criteria for ADHD [9, 10]

Children or adolescents are classified as either having primarily inattentive type of ADHD or primarily hyperactive-impulsive type or a combined diagnosis of both if criteria of both are present.

Primarily inattention type is diagnosed in the age group of 6–16 years of age if six or more symptoms of inattention have been present for at least 6 months. These include:

- Fails to give close attention to details or makes careless mistakes in schoolwork, at work, or with other activities
- Has trouble holding attention on tasks or play activities
- Does not seem to listen when spoken to directly
- Does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (e.g., loses focus, side-tracked)
- Has trouble organizing tasks and activities
- Avoids, dislikes, or is reluctant to do tasks that require mental effort over a long period of time (such as schoolwork or homework)
- Loses things necessary for tasks and activities (e.g. school materials, pencils, books, tools, wallets, keys, paperwork, eyeglasses, mobile telephones)
- Is easily distracted
- Is forgetful in daily activities

Predominantly hyperactive/impulsive type is diagnosed in the age group of 6–16 years if six or more symptoms of hyperactivity-impulsivity have been present for at least 6 months.

Hyperactive symptoms include:

- Often fidgets with or taps hands or feet, or squirms in seat
- Often leaves seat in situations when remaining seated is expected
- Often runs about or climbs in situations where it is not appropriate (adolescents or adults may be limited to feeling restless)
- Often unable to play or take part in leisure activities quietly
- Is often "on the go" acting as if "driven by a motor"
- Often talks excessively

Impulsive symptoms include:

- Often blurts out an answer before a question has been completed
- Often has trouble waiting their turn
- Often interrupts or intrudes on others (e.g., butts into conversations or games or activities)

Combined type is diagnosed if at least 6 symptoms of both inattention and hyperactivity/impulsivity are present for at least 6 months.

Whatever the type, symptoms must be present and impair proper functioning in at least two settings (school, home, sport, etc.) and must start before reaching the age of 12 years. Also, the child must not have any other comorbid disorder that may cause such symptoms (mental, developmental, psychiatric, or sleep disorder).

The validated form of the Arabic version of DSM-5 [11] was used and was completed by the parent (mostly the mother).

C. Conners rating scale-revised, long version—parent scale

Conners Parent Rating Scale-revised (CPRS-R), long version, is an assessment tool used to detect symptoms of ADHD and to classify its' subtypes based on the parent's observations about the youth's behavior [12]. It is an 80-question tool, and parent responses are scored based on the frequency of occurrence of the symptom from 0 (not true or rarely true) to 3 (very true or very often true). It is completed by most parents within 20 min [13]. A standardized *T* score is calculated where the average scores range usually falls between 40 and 59 (within one standard deviation of mean). Scores from 60 to 64 are considered borderline or "high average" (within 1–1.5 standard deviations above mean) and require careful clinical judgment. Scores in the range of 65–69 are in the "elevated" range and usually indicate more concern than is typically reported. T scores at or above 70 (> 2 standard deviations above the mean, "very elevated" range) are very likely indicative of a significant area of concern [14].

The scale assesses a variety of behavioral problems in children and adolescents, including oppositional, cognitive problems/inattention, hyperactivity, anxious-shy, perfectionism, social problems, and psychosomatic behavioral problems. Several subscale indices are calculated from the scale, including an ADHD Index, three DSM-IV symptoms' indices, and Conners global indices. The ADHD index is useful in identifying children and adolescents who may meet DSM-5 criteria for ADHD. There is strong evidence for ADHD when the ADHD index, the DSM Symptoms' Indices, the Hyperactivity Subscale, and the Cognitive Problems/Inattention Subscales are all elevated [13].

It is important to note that combining information gathered from each psychometric measure together with interviews, observations, and review of available records is needed and gives the assessor a more comprehensive view of the youth than might be obtained from any one source, so that correct decisions can be made.

Statistical analysis

The collected data were revised, coded, and introduced using IBM SPSS Statistics version 17. Continuous variables were represented by the mean and standard deviation, while categorical variables were represented by percentages. Non-normally distributed variables were represented as median and interquartile ranges. Comparisons between the groups were made using an unpaired *t*-test, analysis of variance, or Wilcoxon signed rank tests for continuous variables and chi-squared test for categorical variables; *p* value of less than 0.05 was considered statistically significant.

Results

Seventy children and adolescents with type 1 diabetes and 70 age- and sex-matched controls were included in the study. There were 36 females and 34 males in the children with diabetes group and 38 females and 32 males in the control group ($p = 0.73$). The age of included subjects (mean ± SD) was 9.56 ± 2.25 years and 10.32 ± 2.93 years for the children and adolescents with diabetes and the controls, respectively ($p = 0.088$). Table 1 shows the duration of diabetes, insulin doses, and glycemic control of included patients. Unfortunately, nearly half (47.14%) of included children and adolescents with type 1 diabetes were in poor glycemic control (HbA1c > 9%) and only about one fifth (21.43%) in good control (HbA1c < 7.5%). Majority of included patients were using insulin multiple daily insulin injections (MDII) by means of insulin pens (only 10% used continuous subcutaneous insulin infusion (CSII) by means of an insulin pump). The scores and psychometric evaluation results of all participants are shown in Table 2.

There was a non-significant correlation between the age at onset of diabetes, diabetes duration, insulin doses, and the value of HbA1c and PSC or CPRS-R scores ($p > 0.05$) as shown in Table 3. Sex and category of metabolic control (good, borderline or poor) also showed a non-significant correlation with all of the psychometric assessment scores ($p > 0.05$).

Discussion

Our study included a cross-sectional sample of children and adolescents with type 1 diabetes. The mean duration of diabetes for all included cases with diabetes was less than 5 years and most subjects had uncontrolled diabetes. A screening PSC score was significantly higher for

Table 1 Duration of diabetes, insulin regimen and glycemic control of included children and adolescents with diabetes

Cases with type 1 diabetes (*n* = 70)	
Age at diagnosis (mean ± SD) years	5.24 ± 2.29
Duration of diabetes (mean ± SD) years	4.29 ± 2.60
Basal insulin dose (IU/kg/day)	0.75 ± 0.20
Bolus insulin dose (IU/kg/day)	0.56 ± 0.20
Method of insulin delivery	
MDII using insulin pens	63 (90.0%)
CSII using an insulin pump	7 (10%)
HbA1c (%)	
Mean ± SD	8.75 ± 1.93
Good control (< 7.5%) (*n*, %)	15 (21.43%)
Borderline control (7.5– < 9%) (*n*, %)	22 (31.43%)
Poor control (≥ 9%) (*n*, %)	33 (47.14%)

Table 2 Psychometric evaluation results of included cases with diabetes and controls

Assessment tool	Control subjects	Cases with diabetes	Test value	*P*-value
PSC				
Median, IQR	5, 4–7	10, 9–12	− 7.23	< 0.001
Range	3–25	3–18		
DSM-5 symptoms				
Predominantly inattentive (*n*, %)	3 (4.3%)	10 (14.3%)	4.155	0.042
Predominantly hyperactive (*n*, %)	4 (5.7%)	12 (17.1%)	4.516	0.034
Mixed type (*n*, %)	5 (7.1%)	13 (18.6%)	4.080	0.044
Overall total, regardless of type (*n*, %)	12 (17.1%)	35(50%)	16.944	< 0.001
Conners parent rating scale—revised				
Score (mean ± SD)	73.37 ± 33.83	97.47 ± 24.39	4.835	< 0.001
Score > 70 (*n*, %)	23 (32.86%)	40 (57.14%)	2.887	0.004

PSC Pediatric Symptom Checklist, *IQR* interquartile range

Table 3 Correlation between the different parameters related to diabetes and the scores on the different psychometric assessment tools

Parameter	PSC score		CPRS-R score	
	R value	*p* value	*R* value	*p* value
Diabetes duration (years)	− 0.062	0.61	− 0.091	0.454
Age at diagnosis (years)	0.232	0.053	0.14	0.248
HbA1c (%)	0.093	0.911	0.153	0.859
Insulin dose (U/kg/day)	0.117	0.418	0.029	0.842

PSC Pediatric Symptom Checklist, *CPRS-R* Conners Parent Rating Scale-Revised

children and adolescents with type 1 diabetes than controls ($p < 0.001$). Significantly larger number of children and adolescents with type 1 diabetes fulfilled DSM-5 criteria for inattentive or hyperactive or mixed type ADHD (14.3%, 17.1% and 18.6%, respectively) as compared to controls (4.3%, 5.7% and 7.1% respectively, $p < 0.05$). Also, a significantly larger number (more than half, 57.14%) had a Conners score above 70 and the mean scores on Conners parent rating scale were also significantly higher for cases with diabetes than controls ($p < 0.001$).

Our study showed a prevalence of ADHD in control children of 17.1% (for all types of ADHD) based on DSM-5 criteria. Previous studies have shown a comparable prevalence of between 16.2 and 20.9% [11, 15–18] among Egyptian children and adolescents in the age group 6–14 years, based on DSM-IV or DSM-5 (all using parent-reported data). Lower rates (~ 6.9%) were reported when primary school children were assessed using teacher reporting in addition to parent reporting [19, 20].

Regarding the prevalence among children and adolescents with type 1 diabetes, a study examining the Swedish pediatric diabetes registry between 1990 and 2013 found an increased risk for having ADHD among patients with childhood-onset type 1 diabetes (3.7% of the cohort had ADHD). The risk increased with increasing HbA1c level with the highest risk observed in those with HbA1c above 8.5% (38.1% of those with HbA1c > 8.5% had ADHD, with an adjusted odds ratio of 2.31) [4]. Based on this study as well as other studies from Sweden, it was concluded that "routine neurodevelopmental follow-up visits should be considered in type 1 diabetes, especially in patients with poor glycemic control" [5]. Moreover, in the multicentric DPV (Diabetes Prospective Follow-up Initiative) registry of pediatric type 1 diabetes in Germany/Austria, it was found that 2.83% of included children and adolescents with type 1 diabetes had ADHD as a comorbid diagnosis. In the DPV cohort, those with ADHD had higher HbA1c as compared to children and adolescents with type 1 diabetes without ADHD (mean HbA1c = 8.6% versus 7.8%, $p < 0.0001$) and suffered twice as often from diabetic ketoacidosis compared to patients without ADHD [21].

On the other hand, in the study of children and adolescents with type 1 diabetes diagnosed before the age of 18 years from the Danish registry [22], it was found that although there was an increased risk of psychiatric disorders, especially after 5 or more years after diagnosis, the increase in risk of development of ADHD was found non-significant when compared to the general non-diabetic control population. The significant increase was mainly found in mood disorders and anxiety, dissociative, eating, stress related and somatoform disorders, psychoactive substance misuse (in boys only), and personality disorders (in girls only) [22]. The authors noted that a possible explanation for their different results when compared to the Swedish data might be due to lack of inclusion of comorbid diagnosis of ADHD with T1DM in the Danish registry.

Compared to previous studies in children and adolescents with type 1 diabetes in European countries, our results showed a higher percentage of children and adolescents with type 1 diabetes with ADHD (between 14.3 and 18.6% based on DSM-5 criteria with 57.14% having Conners score in the ADHD diagnostic range). A possible explanation might be due to the poor metabolic control among most of our included patients with only 21.13% having HbA1c below 7.5%, which is still not the optimum target.

Moreover, it is important to note that for ADHD diagnosis, it is important to document impairment of normal functioning in two different settings (home, school, sports, etc.) [9]. Therefore, our study needs to further evaluate these children and adolescents by a second informant, for example a teacher. Several studies (from Egypt and worldwide) have shown that parents report ADHD symptoms more frequently than teachers [19, 20, 23–29] and that parents may not have age-appropriate behavioral expectations for their children causing overdiagnosis of ADHD. Parents were found to be more reliable in ratings of forgetfulness, whereas teachers were found to be more reliable reporters of deficits in sustained attention (teachers can quickly compare students and detect those poorly performing in a class task) [23, 30]. In addition, mothers (the main informants in our study) were found to consistently report more inattention and hyperactivity symptoms than fathers (mothers spend longer times with children than fathers and many children behave better in the presence of their father) [23, 24, 28, 31].

The much higher percentage of possible ADHD children detected by Conners score in our study (57.14% scored above 70) may be due to the high sensitivity of CPRS-R in detecting ADHD but its relative poor specificity [29, 32, 33]. Clinician-based rating of ADHD symptoms based on a semi-structured parent interview was found to have superior sensitivity compared to parent-filled out CPRS-R questionnaires [29].

A recent systematic review found that overdiagnosis of ADHD may occur due to diagnostic inflation with the newer criteria for diagnosis which widened the definition of ADHD to include ambiguous or mild symptoms, and in patients with those symptoms, harms may outweigh the small benefits of treatment [34]. For such mild cases of ADHD, experts have suggested a stepped approach for diagnosis to avoid overdiagnosis without missing real cases. In this approach, baseline information is collected from several sources first, explanations for behavioral problems are sought (sleep deprivation, challenges/tensions in school or home, etc.), and then watchful waiting is done with monitoring and follow-up without active treatment. Then, if the problems persist, help is offered in the form of brochures or parent training on how to deal with hyperactive children. This is done without using the term ADHD but rather referring to the child as having "concentration problem, restlessness or behavioral problem". If minimal intervention is not enough and problems persist, a short 5–6 session counseling is offered to teach attitudes and coping skills in dealing with hyperactivity, concentration impairment. If problems still persist, referral to secondary care (psychiatrist or developmental pediatrician) for definitive diagnosis and proper treatment is advised [34].

Despite all of the above factors and given that the percentage of ADHD of our control arm compares to that of several previous studies among non-diabetic children and adolescents, our results show an alarming prevalence of ADHD among children and adolescents with type 1 diabetes based on all the three different methods of assessment carried out. Based on the standardized DSM-5 criteria, a significant difference was evident between cases with type 1 diabetes and control subjects (a prevalence of 14.3–18.6% versus 4.3-–7.1%, $p < 0.05$). It was surprising to find such a high percentage of individuals likely having ADHD; only two patients are being followed in the childhood psychiatry clinic, but none of the rest is following up in a psychiatry clinic or is aware of the need for further evaluation by a psychiatrist.

Unlike previous studies which were mainly longitudinal studies based on different European registries, our study is a cross-sectional one that aimed to screen for the presence of ADHD among a sample of children and adolescents with type 1 diabetes as compared to controls. Egypt is a developing country with higher poverty levels compared to Sweden, Germany, and Austria. A major problem in Egypt (and as such in other developing countries) is that parents are busy working day and night striving to provide the daily living. Together with lack of awareness of ADHD, the diagnosis may easily be missed. Also, not every diabetes clinic has a psychiatrist working as an integral part of the multidisciplinary team of the clinic, but rather when a need is spotted, the patient is referred to a psychiatrist/psychiatric clinic (as is done at our university hospital clinic). This may also cause delay and missing of the diagnosis of neuropsychological disorders such as ADHD, which reflects on both glycemic control and the underlying disorder.

Early diagnosis of ADHD among children and adolescents with diabetes is important as ADHD patients may miss/miscalculate insulin doses due to inattention or forgetfulness. Also, in those with hyperactivity, there will be an increased risk of hypoglycemia that must be put into consideration when designing their insulin therapy. Both these factors may result in poor glycemic control which is also known to cause neuro-psychological functional

impairment, resulting in a vicious circle. The longer the duration of delay in diagnosis, the worse will be the glycemic control [35]. The diagnosis of diabetes itself adds extra stress to ADHD patients. Moreover, patients with ADHD may need different educational material for their diabetes management with the use of more pictures to overcome their easy distractibility [36]. They would also need more frequent visits as compared to non-ADHD patients. In our study, although no correlation was found between scores on ADHD testing and HbA1c value, it is likely that this is because glycemic control in the majority of our patients was inadequate with only about one fifth achieving good control.

Conclusion

In conclusion, our study indicates a real need to evaluate children and adolescents with type 1 diabetes for ADHD, especially those in poor metabolic control. This is important so that insulin therapy can be properly instituted (while accounting for the risk of hypoglycemia or hyperglycemia with inattention, forgetfulness, and hyperactivity) and proper educational material can be used (with more use of pictures in handouts, toolkits and educational videos). In addition, ADHD management would be more properly carried out, given the risks of neuropsychological dysfunction associated with fluctuations in blood sugar. Further larger scale studies may explore the pathophysiologic/etiologic link between type 1 diabetes and ADHD.

Our study is not without limitations. One limitation is that parent questionnaire data was mainly based on parent reporting (mainly by mothers), no teacher or other informant reporting was obtained, and no semi-structured interviews were carried out. Yet, it also has several strengths. It represents the first evaluation for the neurobehavioral disorder of ADHD in our diabetes clinic. Also, evaluation for ADHD was carried out using multiple different ways: the PSC (the long 35-item form), DSM-5 criteria, and CPRS-R (the long 80-item form). In addition, our study included a control group so that factors affecting the patient arm would equally affect the control arm.

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Authors' contributions
Eman A AbdelAziz, Hanan H Aly, and Batoul M AbdelRaouf conceptualized, designed, and together with Mohamed A Mousa conducted the study. Mohamed A Mousa did the data acquisition. All authors contributed to the literature review. Batoul M AbdelRarouf revised the questionnaires. Hanan H Aly wrote the final manuscript. All authors revised and approved the submitted manuscript and agreed to publish it in the Egyptian Pediatric Association Gazette.

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Availability of data and materials
All data generated or analyzed during this study are included in this published article.

Declarations

Ethics approval and consent to participate
The study was approved by the Research Ethical Committee of Pediatric Department, Faculty of Medicine, Ain Shams University. Informed written consents were obtained from the participants' guardians and adolescent participants prior to the inclusion in the study. Ethical approval was obtained from the Research Ethics Committee at the Faculty of Medicine (Ethical Committee No. FMASU R 568/2020).

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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