School Achievement of Primary School Children with Type 1 Diabetes Mellitus in Baghdad

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Abstract

Background: Children spend many hours a day at school and the overall goals for children in these settings are to maintain excellent glycemic control and minimize interruptions of their daily learning. The aim of current study was to assess the school achievement of primary schoolchildren with Type 1Diabetes Mellitus in Baghdad and identify the main factors affecting this achievement. Methods: This comparative cross-sectional study was conducted in a sample of primary schools in Baghdad City selected by multistage cluster sampling. All primary school students in the selected schools were included. For every diabetic child, we selected a child from the same class who is free from diabetes. Information on school achievement, sociodemographic variables and disease history were obtained through interviewing the children and their parents. Poor performance was considered if the student had grade point average <5 point or skipping from school or number of days absent >10 days or had a school year repeated. Results: Diabetic group had significantly higher number of absenteeism days than non-diabetic group (P<0.001). Nearly, 30% of diabetics had poor school achievement compared to only 1% of non-diabetics (P=0.001). Factors contributing to poor performance, as demonstrated by logistic regression analysis, were: student’s age group ≥2 years (P=0.015), low mother education (P=0.049), family income <500,000 Iraqi dinars (P=0.032), weight for age <5 percentile (P=0.049) and follow up visits <4 times/year (P=0.034). Conclusion: One third of diabetic children had poor school achievement. Poor quality of care was the most important modifiable risk factor. Regular follow up visits should be enhanced.

Keywords: School achievement, type 1 Diabetes mellitus, follow up, body weight.

How to cite this article: Saeed K, Hayder S, Al Lami F (2019): School achievement of primary school children with type 1 diabetes mellitus in Baghdad, Ann Trop & Public Health; 22(9): S268. DOI: http://doi.org/10.36295/ASRO.2019.220913

Introduction

Type 1 diabetes mellitus (T1DM) is one of the most common chronic diseases of childhood(¹). Children can spend up to 8 hours a day at school. The overall goals for children in these settings are to maintain excellent glycemic control, minimize interruptions of their daily learning, prevent complications, and prevent or eliminate any stigmatization
related to their disease (2). Previous studies showed that despite a well-developed diabetes care system in Sweden, they have not succeeded in preventing the disease from affecting school achievements (3). One study showed that hypoglycemia and hyperglycemia had qualitatively different effects on cognitive function in T1DM that depend in part on the timing of exposure during development, independent of age of onset (4). For most children with diabetes, medical variables are not as strongly associated with academic achievement as are factors such as socioeconomic status and behavioral factors (5). Debate continues over the role of T1DM on school achievement. Therefore, the aim of current study was to assess the school achievement of primary school children with type 1 Diabetes mellitus in Baghdad and to identify main factors affecting this achievement.

Patients and Methods

This is a comparative cross-sectional study that was conducted in primary schools in the catchment area of 12 primary health care centers (PHCCs) in Al-Karkh side of Baghdad city selected by multistage cluster sampling during the period from 15th February 2018 to 1st May 2018. The study population included all primary school students in the selected PHCCs (all T1DM students in these schools and an equal number of children from the same class and same gender who were free from T1DM) were included.

Exclusion criteria

School children with any other chronic disease(s) or comorbidities and duration of DM <1 year were excluded from current study.

Data collection tools

Two different types of questionnaires were employed to all participants to collect the required information. The first questionnaire was filled by the researcher through direct interview with the primary school teachers. It included questions to gather information on certain student’s variables, criteria of school achievement, anthropometric measures (the Centers for Disease Control and Prevention (CDC) growth charts (6) was used), and school variables (presence of a nurse/trained person on management of DM or not). The second questionnaire was translated into Arabic language and was sent to parents of the study group to gather information on certain sociodemographic variables: educational level (illiterate, primary school, secondary school, college and higher education), occupation (employed, unemployed and retired) and monthly income (<500,000 Iraqi Dinar (ID), 500,000 – 1,000,000 ID, 1,000,000 – 2,000,000 ID and >2,000,000 ID). Additional questions were sent to the diabetics group to gather information about disease variables: age at onset of diabetes and duration (early onset diabetes has been variously defined as occurring anywhere from age 4 to age 7 years old (8); in this study we chose the age 7 years as a cut-off point), frequency of blood glucose monitoring per day), follow up visit for PHCC, diabetic center or private doctor in the last 6 months and the value of the last HbA1C test for the child was recorded if available.

Normal school achievement was considered when the student had met all of the followings: Grade Point Average (GPA) ≥5 and not skipping from school, number of days absent ≤10 days and had not repeated a school year. On the
other hand, Poor school achievement was considered when they had met one of the followings: GPA <5 or skipping from school, number of days absent >10 days or a school year repeated.

**Statistical Analysis**

The Statistical Package for the Social Science (SPSS; release 11.0 for Windows; Chicago, IL) was used for data entry and analysis. Descriptive statistics were used to summarize subjects' characteristics and questionnaire results. In addition, Chi-squared test of independence and Fisher's exact test were used to test quality and frequency of data. Chi-squared for median was used to test association between 2 groups medians. $P$ value of <0.05 was considered significant. Logistic regression analysis was applied to identify the significant independent and unconfounded factors.

**Results**

The total number of primary schools in the selected area was 141 schools. The total number of diabetics was 110 but five students were not included because of having other chronic disease. About 53.3% of diabetics have had excellent grade in comparison to 76.2% in the non-diabetics. Diabetic group had significantly higher number of absenteeism days than non-diabetic group. Nearly 30% of diabetic students had poor school achievement compared to only 1% of non-diabetics, which was statistically significant (Table 1).

Regarding the predictors of school achievement among diabetic and non-diabetic groups, data from current study showed that they were all statistically significant (Table 2). The highest proportion of poor achievement was found in age group ≥12 years (46.2%) with significant association but there was no significant association with gender or presence of a trained nurse. The only significant association with the studied sociodemographic characteristics was with mother occupation as the highest proportion of good achievement (85.2%) was found in the employed group.

Around 74.7% of diabetics who had normal weight for age and 83.3% who had above normal weight had good achievement at school while 80.0% of the low-weight diabetics had poor achievement at school and these results were statistically significant. Around 90% of those who are diabetes for 3-6 years had good achievement but it decreased to 55.6% and 63.6% in ≥7 years and <3 years of diabetes duration, respectively, and these results were the only statistically significant finding according to disease variables. Follow up visits to either PHCCs, Diabetic Centers or private physician was found to be significantly associated with school performance as 79.4% of patients who had ≥2 visits were good performers. Factors contributing to poor performance as demonstrated by logistic regression analysis were shown in Table (3).

**Discussion**

The higher percentage of poor school achievement among diabetics agreed with many studies. However, disagreed with this finding as they found that following adjustment for confounders (careers education and school attendance), no difference in performance was observed between diabetics and their peers and explained these results to the cohort being more contemporary, being treated during a period of improved, more stable glycemic
control with access to modern diabetes therapies (e.g. insulin pump therapy)\(^{(13)}\). Furthermore, a decline in mean HbA1c from the 1990s to the 2000s from over 10\(^{\%}\)\(^{(14)}\), to 8.3\(^{\%}\) was noted in Western Australia\(^{(15)}\). In current study, modern therapies and control methods are still limited and expensive. Only one of the diabetics had continuous glucose monitoring and none of them had an insulin pump. Diabetic group had significantly higher number of absenteeism days than non-diabetic group which agreed with \(^{(16)}\)and \(^{(12)}\). The most common reasons, given by teachers, for school absences were minor illnesses such as sore throat or respiratory tract infection, feeling sick due to their diabetes and appointments for follow up visits. One study found that 30\(^{\%}\) of children with chronic health condition including diabetes had repeated one school year \(^{(17)}\), which agreed with our study. The percentage of skipping school or failing midyear exam was 4.8\(^{\%}\) in comparison to 0.0\(^{\%}\) in non-diabetics, which agreed with \(^{(3)}\). The majority of diabetics who had low weight for age had poor achievement at school since cognitive deficits observed frequently in children with poor glycemic control\(^{(1)}\) and poor glycemic control usually results in poor weight gain\(^{(18)}\). In this study, low weight for age may be used as an indirect indicator of poor glycemic control. Only 42.9\(^{\%}\) of children in the current study had documented HbA1C results which disagreed with \(^{(5)}\). The decline in achievement in those with \(\geq7\) years duration of diabetes group agreed with \(^{(9,19)}\) as they found that six years after onset of disease, children with T1DM performed poorer than control subjects. Poor achievement in children with \(<3\) years duration of diabetes group may be explained by parental psychological distress at diagnosis as 19\(^{\%}\) of parents reporting distress 1-4 years after diagnosis\(^{(20)}\), diabetes-related distress was significantly associated with poor diabetes self-management, lower quality of life and higher rates of diabetes complications\(^{(21)}\). Although age of onset was not significantly associated with school achievement, two studies with larger sample size found that learning was more affected for children with early-onset than late-onset diabetes\(^{(3,11)}\), whereas another two studies\(^{(5,12)}\) found that early onset of diabetes was not associated with lower scores at school. Optimal glycemic control is dependent upon frequency of monitoring blood glucose\(^{(1,21)}\). Only one third of diabetics had frequently checked their blood glucose \((\geq4\) times/day) and they had marginally better achievement, yet it was not statistically significant. No studies investigated this association at time of current study. School nurses are an obvious on-campus resource for diabetic students\(^{(22)}\). In current study, 17.1\(^{\%}\) of the children had trained staff at school which was less than half (43\(^{\%}\)) of a Swedish study\(^{(23)}\). Although there was no significant association between the presence of a nurse at school and achievements, \(^{(24)}\) showed that elementary schools with a full-time school nurse had fewer medically-related student dismissals and that being absent during instruction time had affected school performance and students’ ability to learn. In general, mothers were more involved than fathers on academic and social lives of their children\(^{(25)}\), and mothers using more planful problem-solving strategies than fathers as coping strategies when facing a child with diabetes mellitus\(^{(26)}\). In a comparison of mother/father involvement in diabetes education in two-
parent families, 83.3% of respondents reported that the mother being more involved and 16.7% of them mother and father had the same involvement (27), which might explain why logistic regression analysis showed that poor school achievement was associated with low mother education and there was significant association between achievement and mother occupation, as the highest proportion of good achievement was found in the employed group. However, there was no significant association with father education or occupation. In USA, children younger than six years may be eligible to receive supplemental Social Security income to help their parents with the economic impact of diabetes management (28). Logistic regression analysis showed that poor achievement was associated with low family income. This was in concordance with (5). Another study showed that lower family socioeconomic status was associated with a significantly poorer glycemic control (1). About 10% of parents didn’t go for follow up visits and 75% went to private doctor for follow up, which might be due to lack of education about the services provided by the PHCCs and diabetic centers in addition to unavailability of new treatment options and lack of investigations. Around 80% of patients who had ≥2 follow up visits/6 months were good performers, which agreed with (29).

Conclusions

It may be concluded that one third of diabetic children had poor school achievement and poor quality of care as reflected by poor follow up, unavailability of novel treatments modalities were the most important modifiable risk factors. In addition, mother education and family income were important factors affecting school performance of diabetic children.

Ethical Clearance

The Research Ethical Committee at scientific research by ethical approval of both Environmental and Health and Higher Education and Scientific Research Ministries, Iraq.

A written informed consent was obtained from parents of each enrolled student. All personal information was kept anonymous. Data were exclusively used for the sake of this study. Administrative approval was granted from Scientific Council of Family Medicine of the Iraqi Board of Health Specializations and Research committee in the Iraq Ministry of Health. Letters of facilitation were obtained from Scientific Council of Family Medicine of the Iraqi Board of Health Specializations to Al-Karkh Directorate of Health, the concerned PHCCs and primary schools.

Conflict of Interest

The authors declare that they have no conflict of interest

Funding

Self-funding.
Table 1: School achievement of diabetic and non-diabetic students

<table>
<thead>
<tr>
<th>School achievement</th>
<th>Diabetics</th>
<th>Non-diabetics</th>
<th>Total</th>
<th>P value (chi square test)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Good</td>
<td>74</td>
<td>70.5</td>
<td>104</td>
<td>99</td>
</tr>
<tr>
<td>Poor</td>
<td>31</td>
<td>29.5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>105</td>
<td>100</td>
<td>105</td>
<td>100</td>
</tr>
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</table>
Table (2): Distribution of study group by school achievement predictors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Diabetics (n=105)</th>
<th>Non-diabetics (n=105)</th>
<th>X²</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Repeated year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>16</td>
<td>15.2</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>No</td>
<td>89</td>
<td>84.8</td>
<td>104</td>
<td>99.0</td>
</tr>
<tr>
<td>Days absent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;10</td>
<td>17</td>
<td>16.2</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>≤10</td>
<td>88</td>
<td>83.8</td>
<td>104</td>
<td>99.0</td>
</tr>
<tr>
<td>GPA &amp; skipping</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skipping or GPA&lt;5</td>
<td>5</td>
<td>4.8</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>GPA 5 -6.9</td>
<td>13</td>
<td>12.4</td>
<td>5</td>
<td>4.8</td>
</tr>
<tr>
<td>GPA 7 -7.9</td>
<td>14</td>
<td>13.3</td>
<td>7</td>
<td>6.7</td>
</tr>
<tr>
<td>GPA ≥8</td>
<td>73</td>
<td>69.5</td>
<td>93</td>
<td>88.6</td>
</tr>
</tbody>
</table>
Table (3): Logistic regression analysis for association of various factors with school achievement

<table>
<thead>
<tr>
<th>Variables</th>
<th>Odd’s ratio</th>
<th>95% C.I for odd’s ratio</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older age ≥ 12 years</td>
<td>7.299</td>
<td>1.459 – 35.714</td>
<td>0.015</td>
</tr>
<tr>
<td>Higher grade (5th-6th)</td>
<td>6.488</td>
<td>1.359 – 30.959</td>
<td>0.019</td>
</tr>
<tr>
<td>Low mother education</td>
<td>6.636</td>
<td>1.009 – 43.656</td>
<td>0.049</td>
</tr>
<tr>
<td>Low income</td>
<td>3.086</td>
<td>1.098 – 8.620</td>
<td>0.032</td>
</tr>
<tr>
<td>&lt;5 weight for age percentile</td>
<td>8.470</td>
<td>1.006 – 71.294</td>
<td>0.049</td>
</tr>
<tr>
<td>Follow up &lt;2 visits / 6 months</td>
<td>1.793</td>
<td>1.046 -3.074</td>
<td>0.034</td>
</tr>
</tbody>
</table>
References