Glycemic Control, Self-Efficacy and Fear of Hypoglycemia among Iranian Children with Type 1 Diabetes

Fatemehsadat Amiri¹, Mohammadreza Vafa¹* and Linda Gonder-Frederick²
¹Department of Nutrition, Iran University of Medical Sciences, Tehran, Iran
²Department of Psychiatry and Neurobehavioral Sciences, University of Virginia Health System, Virginia, USA

Abstract

Introduction: Managing diabetes in children presents many challenges and we hypothesized some factors including child’s fear of hypoglycemia and beliefs about their ability to manage their illness, could affect glycemic control.

This study was designed to test the reliability of a Persian version of two questionnaires to assess whether these questionnaires can be useful tools for quick assessment and developing targeted educational interventions or not. Also, this study examined the level of fear of hypoglycemia and self-efficacy for diabetes management and their association with HbA1c and parents’ demographic characteristics in a sample of children with type 1 diabetes.

Methods: Sixty one children with type 1 diabetes (35 boys, age: 6.0-12.7 years) were assessed using the Hypoglycemia Fear Survey-Child version (HFS-C) and Self-Efficacy for Diabetes Scale-Child version (SED-C). Their glycemic control was evaluated by glycated hemoglobin (HbA1c) levels.

Results: Internal consistency of the Persian version of HFS-C and SED-C were very good. Our results showed that children >10 years old report lower level of fear and worry about hypoglycemia which is likely relate to higher level of self-efficacy(r=-.3, p=.025 and r=-.3, p=.02 respectively). 42.3% of girls and 31.4% of boys reported that low blood sugar is a big problem for them. These findings suggest that fear of hypoglycemia is a significant concern for this target group. Only 19.7% of children had controlled diabetes based on HbA1c which trended higher in children 10 and older. There was no significant association between higher HbA1c and other variables including HFS-C, SED-C and parents’ demographic characteristics (education and employment).

Conclusions: The Persian version of HFS-C and SED-Care reliable and valid measure of the fear of hypoglycemia and self-efficacy in children with type 1 diabetes and these questionnaires could be used in our country for identifying those children who may need diabetes education and other supports. Association between greater self-efficacy and lower fear of hypoglycemia recommend that training can reduce levels of fear and improve disease management. Although children are dependent to their parents for managing diabetes, we have focus on children more in diabetes management because they have much potency to do it and increased knowledge by educating diabetes self-management tasks could result in better glycemic control and alleviate fear of hypoglycemia.

Keywords: Hypoglycemia; Fear, Self-efficacy; Type 1 diabetes; Education

Abbreviations: HbA1c: Glycated hemoglobin; HFS-B: Hypoglycemia Fear Survey-Behavior Subscale; HFS-W: Hypoglycemia Fear Survey-Worry Subscale; HFS-C: Hypoglycemia Fear Survey-Child Version; FoH: Fear of Hypoglycemia; SED-C: Self-Efficacy for Diabetes Scale-Child Version

Introduction

Type 1 diabetes is usually diagnosed in childhood and adolescence and the incidence rate is increasing worldwide including many parts of Asia [1]. It is predicted that in European children under the age of 15 years, the incidence will rise by 70% between 2005 and 2020 [2]. Of the estimated 430,000 prevalent cases of childhood type 1 diabetes worldwide, more than one quarter are from Southeast Asia [1].

The Diabetes Control and Complications Trial [3] and its long-term follow-up study, the Epidemiology of Diabetes Interventions and Complications (EDIC) study [4], have shown that a period of poor control can cause lasting damage effect, even if control later improves, so it is important to aim at good control from diagnosis [5].

Surveys of glycemic control from the United Kingdom, Europe, and Australia have consistently demonstrated that many children and adolescents do not achieve targets for glycemic control [6-8]. In children from Asia, however, there is relatively limited information available on glycemic control, management, and prevalence of diabetic complications, although high rates of microvascular and macrovascular disease have been reported in adolescents and adults [9,10]. Diabcare Asia 1998 reported an overview of diabetes management and complications in patients from 230 centers in Asia of the 24,317 participants, only 152 (0.7%) were younger than 18 years. The mean glycated hemoglobin (HbA1c) level was higher in this younger subgroup (10.7% ± 3.0%) than in the whole cohort (8.6% ± 2.2%) [9].

Managing diabetes in children presents many challenges and especially children’s inability to recognize and verbalize symptoms of
glycemic control was evaluated by glycated hemoglobin (HbA1c) (SED-C (to assess confidence in managing their diabetes. Children's additional questionnaire including Self-Efficacy for Diabetes Scale HFS-C (both Behavior (HFS-B) and Worry (HFS-W) subscales) and parent's help. Children completed a battery of questionnaires, including was defined as children's hypoglycemia with consciousness but needs for insulin intervention. Severe hypoglycemia history questionnaire, including an item to assess frequency of severe hypoglycemia episodes in the last 3 months. Severe hypoglycemia maybe associated with better management. Researches on self-efficacy within the diabetes literature are limited [11,19,20].

Because examining child behaviors may offer important information for interventions to achieve optimal diabetes management in children with type 1 diabetes and to the best of our knowledge, there has been no previous research or questionnaires in this field in our country; this study was designed to test the reliability of a Persian version of the HFS-C and SED-C to assess whether these questionnaires can be useful tools for quick assessment for developing targeted educational interventions or not. Also, this study examined HFS-C and SED-C levels and their association with HbA1c and parents' demographic characteristics in a sample of children with type 1 diabetes.

Methods

Participants and procedure

Families were identified through a review of the "Gabric Diabetes Education Association" (http://www.gabric.ir/about/en) database from 2005 to 2012, and then contacted by a member of the research team. Parents were eligible to participate if had a child 6-12 years old who had been diagnosed with type 1 diabetes for at least 6 months. Families were excluded if the child suffered from another disease known to affect growth or other autoimmune disease (e.g., thyroid, celiac). A total of 75 families were approached for the study and 61 agreed to participate and were eligible (81.33% recruitment rate). Parents and children came to the office of the Gabric Diabetes Education Association (GDEA), where parents provided written informed consent, then completed diabetes history questionnaire, including an item to assess frequency of severe hypoglycemia episodes in the last 3 months. Severe hypoglycemia was defined as children's hypoglycemia with consciousness but needs parent's help. Children completed a battery of questionnaires, including HFS-C (both Behavior (HFS-B) and Worry (HFS-W) subscales) and additional questionnaire including Self-Efficacy for Diabetes Scale (SED-C (to assess confidence in managing their diabetes. Children's glycemic control was evaluated by glycated hemoglobin (HbA1c) levels which was analyzed on whole blood collected in EDTA vacutainer tubes and measured by a designated high-performance liquid chromatography (HPLC) method (Tosoh G7 Automated HPLC Analyzer; Tosoh Bioscience, Grove City, OH). The recommended value is < 8% for children and adolescents with type 1 diabetes [21]. Blood samples for HbA1c analysis were taken on the same day when questionnaires were completed at a laboratory next to the GDEA. The study design was cross-sectional and was approved by the Medical Ethical Committee of Tehran University of Medical Science.

Measures

Questionnaires were translated into Persian for this study using the translation process recommended by the World Health Organization (http://www.who.int/substance_abuse/research_tools/translation/en), which includes forward and backward translation, pre-testing, and cognitive debriefing.

Hypoglycemia fear: We used the Hypoglycemia Fear Survey-child version (HFS-C) to assess children worries and behaviors related to their hypoglycemia [13]. HFS-C is a 32-item survey that includes a 15-item Worry subscale (HFS-W) and a 10-item Behavior subscale (HFS-B) and 7 items about hypoglycemia in special situations. The items in the Worry subscale measure anxiety-provoking aspects of hypoglycemia and the items in the Behavior subscale measure specific behaviors to avoid hypoglycemia [13]. The items are rated on a five-point Likert scale ranging from 1 (never) to 5 (always). The HFS-C subscale scores and the total score are obtained by summing the items for respectively the Worry subscale (range 15–75), the Behavior subscale (range 10–50) and the HFS-C total (range 25–125) [13]. Higher scores indicate higher FoH.

Children confidence: Children confidence in managing their diabetes was assessed using the Self-Efficacy for Diabetes Scale (SED-C) [22]. The SED-C is a 24-item self-report measure that assesses respondents' confidence in performing daily diabetes management tasks (e.g., insulin injections, figuring out meals and snacks, tracking of blood sugar levels) themselves. Children respond using a five-point Likert scale ranging from 'very sure I cannot' to 'very sure I can'. Higher scores indicate more efficacies in diabetes management tasks.

Data analysis

Sample characteristics and HFS-C and SED-C scores were examined with descriptive statistics including means, standard deviations (SD), and frequencies. We used Pearson correlation analysis to compute the association between HFS-C and SED-C scores. Two-tailed Pearson correlations were also used to explore associations of children's HFS-C and SED-C scores with demographic/clinical data. Because of the importance of age and duration of diabetes in children, all of the analyses compared across age (< 9 and ≥ 10 years) and diabetes duration category (< 24 and ≥ 24 months) too. Descriptive statistical analyses, correlations, group comparisons, and Cronbach's alpha reliability analyses were performed with SPSS statistical software (SPSS Inc., Chicago, IL, USA). A probability value of less than 0.05 was considered statistically significant at 95% confidence interval.

Results

Parents of 61 children (60 mothers and 45 fathers) completed the diabetes history questionnaire. Mothers were between 25 and 49 years of age (36.2 ± 5.6), the majority were high school graduates (65.6%) and 75% did not work outside the home. Fathers were between 30 and 58 years of age (42.0 ± 5.9), the majority were high school graduates (64%) and employed (94.8%).
All parents reported being of Iranian nationality. Table 1 presents the demographic and clinical characteristics of the 61 children.

The first question addressed was reliability of Persian version of HFS-C and SED-C in this target age. Internal consistency of the HFS-C and SED-C were calculated using Cronbach's alpha coefficient for the total scale and each subscale. Cronbach's alpha for the HFS-C showed good internal consistency for the Worry subscale (0.89), the Behavior subscale (0.93) and the HFS-C total (0.89). Table 2 shows Cronbach's alpha coefficient of this study in comparison with coefficient reported by Gonder-Frederick et al. [23]. Also, results found alpha coefficients of 0.86 in children for the SED questionnaire, which showed good internal consistency in Persian language too.

Table 3 summarizes the mean scores and SDs for the HFS-C and SED-C measures across age category (≤9 and ≥10 years). Children less than 9 year old had significantly lower mean HFS-W, HFS-T scores than participants over 10 year old (p<.0001).SED scores in 48.3% of children were above the midpoint cut-off (≥ 72). Also, children less than 10 year old had significantly lower mean SED scores (p<.0005).

### Table 1: Children's demographic and clinical characteristics.

<table>
<thead>
<tr>
<th>Child age (years)</th>
<th>n (%)</th>
<th>Mean (range)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-8*</td>
<td>56</td>
<td>51</td>
<td>62</td>
</tr>
<tr>
<td>9-11*</td>
<td>51</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>12-18*</td>
<td>61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current study</td>
<td>56</td>
<td>51</td>
<td>62</td>
</tr>
</tbody>
</table>

* Cronbach's alpha values reported by Gonder-Frederick et al. [23] in aggregating data from several separate studies in 6-18 year old persons over the past decade.

### Table 2: Cronbach's a for children hypoglycemia fear survey scores by age group.

<table>
<thead>
<tr>
<th>Children (≤9 years)</th>
<th>Mean (range)</th>
<th>SD</th>
<th>Children (≥10 years)</th>
<th>Mean (range)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFS-B</td>
<td>31</td>
<td>24.8 (12-38)</td>
<td>7.7</td>
<td>31</td>
<td>21.4 (6-37)</td>
</tr>
<tr>
<td>HFS-W</td>
<td>31</td>
<td>31.1 (4-60)*</td>
<td>14.7</td>
<td>31</td>
<td>16.9 (0-43)*</td>
</tr>
<tr>
<td>HFS-T</td>
<td>31</td>
<td>53.3 (19-94)</td>
<td>17.9</td>
<td>31</td>
<td>39.2 (6-75)*</td>
</tr>
<tr>
<td>SED</td>
<td>31</td>
<td>60.5 (39-94)</td>
<td>12.2</td>
<td>31</td>
<td>78.0 (35-108)</td>
</tr>
</tbody>
</table>

* Cronbach's alpha values reported by Gonder-Frederick et al. [23] in aggregating data from several separate studies in 6-18 year old persons over the past decade.

### Table 3: Mean Hypoglycemia Fear Survey–Child version (HFS-C) and Self-Efficacy for Diabetes Scale-child version (SED-C) in children (aged 6–12.7 years) with Type 1 diabetes.

<table>
<thead>
<tr>
<th>Question</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is low blood sugar a big problem for you?</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>26</td>
</tr>
<tr>
<td>Have you ever passed out due to hypoglycemia?</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Have you ever had a hypoglycemic episode while asleep?</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Have you ever had a hypoglycemic episode while you were awake but by yourself?</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Have you ever had hypoglycemia in front of friends or strangers?</td>
<td>16</td>
<td>23</td>
</tr>
<tr>
<td>Have you ever had hypoglycemia when you were at school?</td>
<td>19</td>
<td>25</td>
</tr>
</tbody>
</table>

### Discussion

The current study specifically examined children's fear of hypoglycemia and self-efficacy in managing their diabetes, while most previous studies in this area, with only a few exceptions [13,24] have focused on parental FoH and SED.

In this study, the HFS-C was used to measure behaviors and worries related to FoH in children with type 1 diabetes in Iran. In comparison with Cronbach's alpha values reported by Gonder-Frederick et al. [23] in aggregating data from several separate studies in 6-18 year old persons over the past decade, our data indicate good internal consistency for HFS-C questionnaire which replicate other researches' internal consistency in this target group [23]. The results of Green et al. study support the internal consistency and test-retest reliability of the HFS in youth too [24]. Also, the SED-C was used to assess children confidence in managing their diabetes that alpha coefficients of SED questionnaire is comparable with the Cronbach's alpha values reported by Grey et al. [25] for adolescents (0.88). These acceptable alpha coefficients for Persian version of the HFS-C and SED-C indicate that these questionnaires are reliable instrument, could be used in our country, and could provide useful tools for assessing level of FoH and self-efficacy in children with type 1 diabetes and identifying those children who may need diabetes education and other important support.

42.3% of girls and 31.4% of boys reported that low blood sugar is
a big problem for them and more than 50% of girls and boys reported they have had hypoglycemic episode while asleep, in front of friends or strangers and at school. These findings suggest that FoH is a significant concern for these children with type 1 diabetes. Although some level of fear is normal and adaptive and could help motivate children and their parents to protect them from hypoglycemic episodes, extreme FoH might lead to poorer coping strategies, such as over-eating to prevent low blood glucose, administering lower doses of insulin and feeding children without administering insulin, subsequently leading to more restrictive insulin doses and declining glycemic control [26].

On the other hand, the majority of these young people attends school and need knowledgeable staff to provide a safe school environment, especially because of serious events like hypoglycemia that need urgent help. Appropriate diabetes care in the school and day care setting is necessary for the child's immediate safety, long-term well-being, and optimal academic performance [27].

In contrast with the finding of another study that suggested worries about hypoglycemia were relatively lower in younger-aged school children with Type 1 diabetes, but then increased to a plateau by the time children were approximately age 9 years or so [23], our results interestingly showed lower level of HFS-W and HFS-T in children >10 yr, which is likely relate to higher level of SED-C. Association between greater self-efficacy and lower FoH indicate that training can reduce levels of fear. Although children are dependent to their parents for managing diabetes, we have focus on children more in diabetes management and use their potency. Increased knowledge by educating diabetes self-management tasks could result to alleviate FoH and maybe better glycemic control.

Studies have not produced consistent results about the impact of FoH on glycemic control (HbA1C), while some finding an association between higher levels of FoH and poorer diabetes control [28,29] and others not finding this relationship [30-32]. Our data that did not identify any association between FoH, self-efficacy and glycemic control and this concept remains unclear. Maybe the relationship between FoH, self-efficacy and diabetes control is not linear and is more complex and also there are other factors in addition to the above-mentioned ones that have an influence on HbA1C. But it is still important to recognize high FoH [23] and needs to be specifically addressed in patient education programs.

Gonder-Frederick et al. reported that FoH was not related to metabolic control, but adolescents who experienced recent severe hypoglycemia with unconsciousness had significantly higher HbA1C [13]. They also showed that frequency of severe hypoglycemic episodes was significant predictors of FoH in adolescents [13]. But in current study, neither FoH nor self-efficacy measures correlated with number of hypoglycemia episodes in last 3 months. Some other studies have also failed to find a relationship between parental FoH and hypoglycemia history [13,33,34]. Perhaps a relationship would have been found with a more detailed assessment of hypoglycemia episodes in last 3 months like that conducted in studies by Haugstvedt et al. [35] and Patton et al. [33] in adult groups and it may be that the qualitative characteristics of hypoglycemia experiences (e.g., the level of associated distress and trauma) may have more influence than the quantitative frequency of episodes in the development of FoH [23].

One somewhat surprising result was poorer glycemic control in children >10 yr, while they had higher self-efficacy and lower FoH. Higher hypoglycemia episodes in last 3 months did not significantly correlate with HbA1C, but trended higher in this age group and may lead to more frequent hyperglycemia and finally higher HbA1C. Finding from this study should be considered within the context of several limitations. First, the relatively small sample size and selection of children from a database, these findings cannot be generalized to the whole community based on this study. Second, the cross-sectional design, there is no way to conclusively state which is the most accurate direction for these associations.

**Conclusion**

This is the first study to specifically measure FoH and self-efficacy of Iranian children with type 1 diabetes. Our results indicate that the Persian versions of the HFS-C and SED-C are psychometrically valid and reliable instruments to measure FoH and self-efficacy in managing diabetes in this target group. Furthermore, findings indicate that higher level of self-efficacy likely go hand in hand with lower worry and concern about experiencing hypoglycemia. So children may benefit from diabetes education, counseling, and problem-solving training to improve their self-efficacy and to better prepare them to manage their diabetes.

Important implications for diabetes education based on findings from the current study are: recognizing diabetes-related fear and self-efficacy in children with type 1 diabetes and addressing children more seriously in diabetes education programs. Structured education courses for all age group of children including these elements may be effective in helping to achieve better metabolic control and clinical outcomes for Iranian children with type 1 diabetes.

**References**

Submit your next manuscript and get advantages of OMICS

Unique features:
• User friendly/feasible website-translation of your paper to 50 world's leading languages
• Audio Version of published paper
• Digital articles to share and explore

Special features:
• 300 Open Access Journals
• 25,000 editorial team
• 21 days rapid review process
• Quality and quick editorial, review and publication processing
• Indexing in PubMed (partial), Scopus, EBSCO, Index Copernicus and Google Scholar etc
• Sharing Option: Social Networking Enabled
• Authors, Reviewers and Editors rewarded with online Scientific Credits
• Better discount for your subsequent articles

Submit your manuscript at: www.editorialmanager.com/acrgroup
