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The development of health literacy scale for acute complications of diabetes for children with type 1 diabetes (8–12 years)

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ABSTRACT

Purpose: This study aimed to develop a Health Literacy Scale for Acute Complications of Diabetes for Children with Type 1 Diabetes (8–12 years of age) and to test the instrument in terms of its psychometric properties.
Methods: The study is of methodological design and was conducted with 222 children, aged 8 to 12 years, with type 1 diabetes who were registered at a training and research hospital's diabetes outpatient clinic. The item pool of the study consisted of 22 statements. Ten experts were asked to review the scale, and when content validity was confirmed, the scale items were amended until the draft scale had 22 items. The children themselves completed the "Diagnostic Form for Children with Diabetes" and "Health Literacy Scale for Acute Complications of Type 1 Diabetes for Children (8-12 years)" questionnaire between June 2021 and October 2022. Exploratory factor analysis (EFA), item-total correlation, and split-half reliability testing were employed for psychometric properties.
Results: The scale comprised 19 items and 3 factors containing information on acute complications of diabetes and health literacy.
Conclusion: A valid and accurate instrument was developed to measure the acute complications of diabetes in children and their health literacy. As such, the scale can be used as a practical tool in evaluating the understanding and implementation skills of children with Type 1 diabetes regarding the management of acute complications of the disease and in assessing their health literacy.

Introduction

Type 1 diabetes, which is characterized by insulin insufficiency resulting from the destruction of the pancreatic cells that secrete insulin, is one of the most common chronic disorders in children (Evliyaoğlu et al., 2020). The number of cases of Type 1 diabetes continues to increase each year in many countries such as Sweden and Finland (Tuomilehto et al., 2020) as a consequence of the rise in incidence and decreasing mortality, confirming that the disease is an issue on a global scale. In 2021, it was estimated that 1,211,900 children and adolescents younger than 20 years of age worldwide had Type 1 diabetes, and that approximately 108,200 children and adolescents under the age of 15 were being newly diagnosed each year (IDF, 2021).

It has been observed that acute (hypoglycemia, diabetic ketoacidosis) or chronic complications (e.g., neuropathy, retinopathy, nephropathy) that children with Type 1 childhood diabetes may encounter throughout their lives can be delayed or even prevented when the disease is managed effectively,. Most children are unable to manage their diabetes effectively due to factors such as gender, parental education levels, and economic status (Delibaş & Erci, 2021; Mendoza et al., 2018). The aim of diabetes treatment is to minimize short and long-term complications by establishing metabolic balance and keeping the blood glucose level stable and within the target range (Hilliard et al., 2018; Pierce et al., 2017). Children with Type 1 diabetes need to be informed about diabetes so that they can be protected from hypoglycemia, hyperglycemia and ketoacidosis, participate in all school activities, and be able to effectively manage emergencies that may arise during activity, thus enjoying a healthy growth and development period (Tarı & Kitiş, 2016). A lack of knowledge may lead to misunderstandings and adversities between children with diabetes and their health providers. Children with low health literacy levels have been reported to have relatively poor glycemic control a and deficient knowledge of diabetes (Kim & Lee, 2016; Powell et al., 2007). One meta-analysis exploring the role of health literacy in being knowledgeable about diabetes, self-care and glycemic index control associated health literacy with the factors of knowledge, self-care and glycemic

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control (Marciano et al., 2019). Health literacy may be defined as understanding interpreting and transforming health information into positive health behavior. Health literacy enables individuals to make decisions about health services throughout their lives to access health services, practice disease prevention, health promotion and improvement (Sørensen et al., 2012). Health literacy in children has gathered increasing significance in the modern world. Developing an understanding of this concept is crucial since understanding has the power to foster the adoption of healthy lifestyle behaviors (Chang et al., 2015; Hsu et al., 2014). Thus, health literacy instruction needs to begin in childhood. The literature also states that child-centered health education should be provided in a way that is relative to the child's age and stage of development (Çınar et al., 2018). In a study conducted with parents of children with Type 1 diabetes, it was reported that the children of parents with inadequate health literacy had significantly high HbA1c levels and that the children of parents with higher health literacy levels had better glycemic control (Hassan & Heptulla, 2010). It is therefore important to make a national effort to determine and increase children's level of health literacy (Çınar et al., 2018).

Research on children and teenagers with Type 1 diabetes in Türkiye has revealed that there are few studies devoted to children's health literacy and body weight (Ozturk Haney, 2020) or to health literacy and the health improvement behaviors of adolescents (Ozturk & Ayaz-Alkaya, 2020). A scan of the literature revealed an absence of studies assessing the health literacy levels associated with the acute complications of diabetes in children with Type 1 diabetes in our country, pointing to a significant gap in the research. It is believed that health literacy is an important determinant of health indicators.

Purpose of the study

This study aimed to develop a Health Literacy Scale for Acute Complications of Diabetes for Children with Type 1 Diabetes (8–12 years of age) and to evaluate the psychometric qualities of the instrument.

Methods

Research questions

Q1. Is the “Health Literacy Scale for Acute Complications of Diabetes for Children with Type 1 Diabetes” reliable?

Q2. Is the “Health Literacy Scale for Acute Complications of Diabetes for Children with Type 1 Diabetes” valid?

Design

This methodological study was conducted in 3 stages. First, the scale items were created. In the second stage, content and face validity were tested. In the third stage, other psychometric properties such as construct validity, internal consistency reliability, item-total correlation and split-half reliability were tested.

Participants

It has been suggested in the literature that the number of individuals to be sampled in scale reliability and validity studies should be 5–10 times the total number of items in the scale (DeVellis, 2017). Our draft scale had 22 items. Therefore, the sample size was planned for 110–220 participants. Taking into account possible case losses, we invited 250 children into the study,. Of these children, 28 refused to participate in the study and so the study was completed with 222 children aged 8–12 years. The study's inclusion criteria included children aged 8–12 with Type 1 diabetes in who visited the Pediatric Diabetes Outpatient Clinic of a Training and Research Hospital in the district of Umraniye, Istanbul. The inclusion criteria for the participants were: having had diabetes for at least a year, being between the ages of 8 and 12 years, absence ofany concurrent disease, and having presented to an outpatient clinic for regular three-month routine checkups. Exclusion criteria were children/parents who refused to participate in the study, incomplete completion of data forms, and children who did not attend regular follow-up visits.

Data collection tools

Sociodemographic characteristics form

The sociodemographic variables in this form, which was prepared by the researchers in keeping with the literature (ADA, 2018; Böber et al., 2020; Ersoy et al., 2020; Evliyaoğlu et al., 2020), included age, gender, and the characteristics of the child with diabetes.

Health literacy scale for acute complications of diabetes for children with type 1 diabetes (DHLS) (8–12 years)

Establishing the Item Pool: An item pool was first created during the development of the DHLS. The researchers read the literature (ADA, 2018; Böber et al., 2020; Ersoy et al., 2020; TEMD, 2022) on acute complications of diabetes and created 22 items for the scale. The scale was created in the form of vignettes in Turkish with responses in varied styles (e.g., multiple choice, true-false, stories, matching items). Guidelines were created for scoring the scale (Appendix 1 and Appendix 2). The participants read the items and filled in the. Questionnaire.

Content Validity: Seeking the opinion of an expert is one way of assessing a study's content validity (Büyüköztürk, 2007). Fourteen experts were approached to evaluate the scale's comprehensibility; ten provided feedbackl. The panel of experts included three diabetes specialist nurses, five academic nurses, a child development specialist fromthe university, and a classroom teacher with experience working with children with diabetes. At the same time, the content validity index (CVI) was used to prove cultural and linguistic equivalence and content validity in numerical values (Esin, 2014). The experts used the Davis method (Davis, 1992) to evaluate how much the children found the items comprehensible and to assess each item's relevance to the topic.

To evaluate the appropriateness of the items, the experts scored the items between 1 and 4 as 1 = not appropriate, 2 = item should be revised, 3 = appropriate, but very little change is needed, and 4 = appropriate according to Davis method (Davis, 1992). The scale was redesigned by evaluating the scores given by each expert for each item and removing the items with a score of 1 and 2. If the experts evaluate 80% of the items between 3 and 4, the CVI score is determined as 0.80. A CVI score of 0.80 and above suggests that the scale's content validity is appropriate (Davis, 1992; Esin, 2014; Yusoff, 2019). The items with a score of 3 were revised in response to the opinions of the experts, and the scale's content validity was established with 22 items.

Face Validity: According to the literature, a sample group with comparable features should be used to test the draft scale before applying it to the entire population (Kartal & Bardakçı, 2018; Yusoff, 2019). After the content validity of the questions developed by the researcher was tested, 15 children were asked to complete a pre-application form. It was found that the participants had no problem with understanding any of the items in the scale, which meant that the scale was capable of measuring what it intended to measure. The face validity of the scale was thus achieved and the implamentation phase of the 22-item draft scale began.

Data collection

The study was conducted in the Pediatric Diabetes outpatient clinic of a Training and Research Hospital in Umraniye, Istanbul from June 2021–October 2022. Prior to the start of the trial, the children who applied for follow-up care at the diabetic outpatient clinic and their parents were contacted, told about the study, after which they were asked to provide their verbal or written agreement. The children

consenting to participate in the study were shown how to fill out the Health Literacy Scale for Acute Complications of Diabetes for Children with Type 1 Diabetes questionnaire and the Sociodemographic Characteristics Form and requested to complete the data collection forms independently. The researcher was there to ensure that no data was lost. It took roughly fifteen to twenty minutes to collect the data.

Analysis of data

The NCSS (Number Cruncher Statistical System) 2007 (License No.: 1675948377483; Serial No.: N7H5-J8E5-D4G2-H5L6-W2R7) was used to analyze the data. The expert opinions in the study were assessed with the content validity index. Exploratory factor analysis (EFA) was employed to ensure construct validity. The scale's reliability was assessed using split-half reliability, item-total score correlation, and internal consistency (Cronbach's Alpha coefficient). Descriptive statistical analysis was used for the sociodemographic data (means, standard deviation (SD), percentages).

Ethical considerations

Ethics approval was obtained from the Marmara University Health Sciences Institute Ethics Committee (Approval Date and Number: 18.01.2021–05). Furthermore, written consent was acquired from the Istanbul Provincial Health Directorate (Approval Date and Number: 28.04.2022/15916306–604.01.01.01-01-5314). The children in the study and their parents were informed about the study and asked to complete the data collection forms anonymously, and the parents' consent was obtained in writing.

Results

Sociodemographic characteristics of the children

The study included 222 children with Type 1 diabetes, 81 (36.5%) boys and 141 (63.5%) girls. The participants' average age was 10.60 ± 1.43, ranging from 8 to 12; the average duration of diabetes duration was 3.64 ± 2.31, ranging from 1 to 4 years; the mean frequency of r blood glucose measurement was 5.76 ± 2.27, ranging from 1 to 12 times a day, and their mean HbA1c result was 9.38 ± 1.76, ranging from 5.70 to 13.0. Only 5 participants were using insulin pumps.

Content validity

Content validity was achieved using the Davis technique (Davis, 1992). Accordingly, the scale's content validity index, which was tested by the panel of experts, was found to be 0.92.

Construct validity

Construct validity was assessed using exploratory factor analysis (EFA). Exploratory factor analysis examines construct validity by exploring the association between factors and their dimensions. Kaiser's eigenvalue≥1 rule is used to ascertain the number of factors in the scale(Kaiser, 1974). Additionally, Bartlett's sphericity test and the Kaiser-Meyer-Olkin (KMO) test were performed to determine whether the data were suitable for factor analysis. The KMO value of the DHLS was 0.718. Bartlett's test sphericity values (χ 2 = 1362,58 df = 171 $p < 0,05$) were found to be statistically significant and it was concluded that the correlation matrix was not a unit matrix. Based on the results of the calculations, it was concluded that factor analysis could be used with this data group. The oblique rotation “Promax” rotation techniquewas utilized in the EFA. Items loading from more than one factor and three items with factor loading differences of >10 were eliminated from the scale in the factor analysis. The scale is thus composed of three factors. It can be observed that 42.4% of the scale's total variables are explained by the three-factor structure (Table 1). Nothing loaded below 0.40. As a result, it was determined that the scale would have 19 items and three factors. The factorial structure of the scale is displayed in the “Screeplot” graph (Fig. 1).

***Factor 1*:** This factor applied to items 1,5, 6, 8B, 10, 11, 12, and 16. These items contain statements related to understanding information on diabetes health literacy. The factor was thus named **“Knowing about the acute complications of diabetes”** (Table 1).

Factor 2: Items numbered 2, 4, 7, 9, 19, and 21 were grouped under this factor. These items include statements about evaluating information related to diabetes health literacy. For this reason, the factor was named **“Interpreting the problems related to the acute complications of diabetes”** (Table 1).

Factor 3: Items numbered 3,8 A,13,14, and 17 were categorized under this factor. These items include statements about the use and application of information regarding Diabetes Health Literacy. The factor was therefore named **“Healthy lifestyle behaviors related to the acute complications of diabetes.”** (Table 1).

When the factor loadings of the items were analyzed, it was seen that item loadings were between.420 and 0.763. The factors and item factor loads obtained as a result of exploratory factor analysis are shown in Table 1. The analysis of the results shows that the first factor consists of 8 items with item factor loads between 0.474 and 0.763, the second factor consists of 6 items with item factor loads between 0.497 and 0.709 and the third factor consists of 5 items with item factor loads between 0.420 and 0.701. All of the item factor loadings are >0.40 (Table 1).

Reliability

The scale's reliability was tested with the techniques of internal consistency reliability, split-half testing, and item-total correlations. The DHLS item-total correlation ranges between 0.301 and 0.782 (Table 1). Since the item-total correlation correlation coefficients were lower than 0.30, three items were eliminated from the scale, and exploratory factor analysis was again performed to finalize the factor structure (Table 1). Cronbach's Alpha was used to assess the scale's internal consistency reliability. Cronbach's Alpha coefficient for the overall scale was found to be 0.804 (Table 2). Table 2 provides the Spearman-Brown and Guttman coefficients computed to assess split-half reliability.

Scoring of the DHLS

The DHLS is composed of 19 items and 3 subdimensions. The first sub-dimension consists of eight items. Possible scores in this factor is a minimum of 0 and a maximum of 8. An increase in the score in this dimension points to a high level of understanding the information about diabetes. Six items make up the second sub-dimension. Scores in this subscale can range from 0 to 6. Elevated scores in this subscale suggest the ability to interpret one's knowledge of diabetes. The third sub-dimension consists of 5 items. The maximum possible score on this subscale is 5; minimum is 0. Higher scores in this dimension indicate that the individual has the ability to apply the knowledge gained about diabetes. Possible scores on this subscale can range from 0 to 19. High scores point to a high level of diabetes health literacy. The scoring guidelines are given both in Turkish and English in Appendix 1 and Appendix 2.

Discussion

Our study aimed to develop the Health Literacy Scale for Acute Complications of Diabetes for Children with Type 1 Diabetes (8–12 years of age) and evaluate the psychometric qualities of the instrument. The literature we reviewed suggests that there is no instrument, developed either in Turkey or abroad, that measures the degree of health literacy

Table 1
Characteristic features of the health literacy scale for acute complications of diabetes for children with type 1 diabetes (8–12 years old) ($N = 222$).

	Factor load	Item Total Correlation Coefficient
Factor 1:Having information about acute complications of diabetes		
1. You attended a birthday party with your friends. Your friends say that everyone can eat as much of the birthday cake as they want at the party. What would you do in this situation?	,478	,475
5. What diabetes-related materials should you have with you when you are at school? (You can tick more than one option).	,633	,735
6. What are the causes of hypoglycemia (low blood sugar)? (You can mark more than one option).	,552	,782
8B) Ayşe is a 10-year-old with type 1 diabetes. When they start the 3rd lesson on Tuesday, symptoms of nausea, vomiting, abdominal pain, sour apple odour (ketone smell) appear in the mouth (You can tick more than one option). In this case, what can be done for Ayşe? (You can mark more than one option).	,474	,581
10. Which of the following are symptoms of hyperglycemia (increased blood sugar)? (You can mark more than one option).	,763	,553
11. Where do you get information about hypoglycemia (low blood sugar)/hyperglycemia (high blood sugar)? (You can tick more than one option)	,708	,566
12. Ayça's fasting blood sugar before lunch is 95 mg/dl and her post-lunch blood sugar is 130 mg/dl. In this case, how would you evaluate Ayça's blood sugar?	,513	,529
15. Hypoglycemia is when our blood sugar drops below 70 mg/dl.	,717	,437
Factor 2: Interpreting the problems encountered regarding acute complications of diabetes		
2. You went out with your friends in the afternoon and want to play a game such as basketball/football/volleyball. What situation would you prevent by measuring your blood sugar before and after playing basketball? (You can mark more than one option).	,511	,608
4. Ahmet is 10 years old, he has recently applied to a health institution with the complaints of drinking too much water, eating too much, urinating too much and sudden weight loss. Ahmet is referred to the Pediatric Diabetes Outpatient Clinic and when he comes to the outpatient clinic, he has acetone odour on his breath and ketones in his urine. What could this emergency be a sign of?	,566	,339
7. Berna is 12 years old and has been followed up in the pediatric endocrinology clinic with a diagnosis of type 1 diabetes for 4 years. Her postprandial blood glucose level is 380 mg/dl in the evening. What should Berna do in this situation? (You can tick more than one option).	,497	,645
9. Which of the following should you do when you have hypoglycaemia (low blood sugar)? (You can tick more than one option)	,535	,498
17. Are you comfortable asking your diabetes doctor/nurse about hypoglycaemia (low blood sugar) / hyperglycaemia (high blood sugar)?	,709	,482
18. Do you find it difficult to read and understand leaflets about hypoglycaemia (low blood sugar) / hyperglycaemia (high blood sugar)?	,636	,355
Factor 3: Healthy lifestyle behaviors related to acute complications of diabetes		
3. You are going to play basketball/football/volleyball with your friends. You feel nervous and tense during the game. You cannot focus on the game and have difficulty concentrating. You start to sweat cold sweat and your hands start to shake. What might you be experiencing?	,603	,301
8 A) Ayşe is a 10-year-old type 1 diabetic. At the beginning of the 3rd lesson on Tuesday, nausea, vomiting, abdominal pain, sour apple smell (ketone odour) in the mouth (You can tick more than one option). What do you think happened to Ayşe?	,420	,475
13. At least how many times a day should you measure your blood sugar?	,431	,461
14. For type 1 diabetics over 7 years of age, blood sugar should be 80–140 mg/dl before sleep.	,500	,319
16. Do you measure your blood sugar regularly every day?	,701	,395

about the acute complications of diabetes in children with Type 1 diabetes between the ages of 8 and 12.

The DHLS will make it easier for children with diabetes to acquire positive behaviors to better manage diabetes and its acute complications (hypoglycemia, hyperglycemia, and ketoacidosis) and. Furthermore, it will also highlight potential deficiencies in chidren's current behaviors through diabetes education. A newly developed scale should fulfill two important criteria: validity and reliability. Validity refers to how well an instrument can actually measure the property it intends to measure. A valid scale needs to be reliable. A measuring instrument is considered reliable if it can perform measurements consistently in the same way at different times, that is, reflecting consistency over time (Davis, 1992; Yusoff, 2019).

Content validity

As per the Davis technique, a CVI of ≥0.80 is considered sufficient for item content validity. The scale is cleared of items whose CVI value is <0.80 (Davis, 1992; Yusoff, 2019). The CGI was determined to be 0.92 in our study that included a panel of ten experts. This value indicates that the experts had a comparable understanding of the items, demonstrating therefore the good content validity of the Diabetes Health Literacy for Acute Complications in Children Scale.

Construct validity

Testing construct validity involves the use of measurement techniques to assess the concepts and qualities measured (Tavşancıl, 2006). A typical method of evaluating construct validity is factor analysis, which combines a large number of related items to produce a smaller number of factors that are consistent with one another. The goal of factor analysis is to simplify the data set to make it easier to explain relationships. Exploratory factor analysis (EFA) is one of the methods used to assess validity. Exploratory factor analysis refers to the process of analyzing the relationships between the variables that comprise a concept or structure, grouping similar variables, and explaining the concept or structure on the basis of fewer factors (Gürbüz & Şahin, 2014; Yaşlıoğlu, 2017).

Exploratory factor analysis starts with determining whether the size of the sample is adequate. The Kaiser-Meyer-Olkin (KMO) test can be used to perform this measurement. A high KMO value indicates that each scale dimension can be fairly accurately estimated by the other scale dimensions (Kaiser, 1974). The KMO value is considered excellent when it is between 0.90 and 1.00, very good when it is between 0.80 and 0.89, and good when it is between 0.70 and 0.79 (Chen et al., 2003). In this study, the KMO value was found to be 0.718, showing that the sample was of adequate size. Also, Bartlett's test values (χ 2 = 1362,58; $p < 0,05$) were found to be significant and thus it was concluded that the correlation matrix was not a unit matrix.

In determining the factors to be included in the scope of exploratory factor analysis, items with an eigenvalue of 1 and greater were accepted as factors and the appropriate number of factors was found by looking at the sharp breaks on the scree plot (Kartal & Bardakçı, 2018). The analysis revealed three factors; the resulting Screeplot can be seen in Fig. 1. According to the graph, since the slope increasingly levels off after the third factor, it can be said that subsequent factors will not make a significant contribution to the scale. For this reason, the number of factors was fixed at 3.

Factor loadings of 0.70 and above point to an excellent relationship, while 0.60–0.70 indicates a high level relationship, 0.50–0.60 a good level relationship, and 0.32 to 0.50 a poor relationship. This value is recommended to be at least above 0.32 (Carpenter, 2018; Osborne et al.,

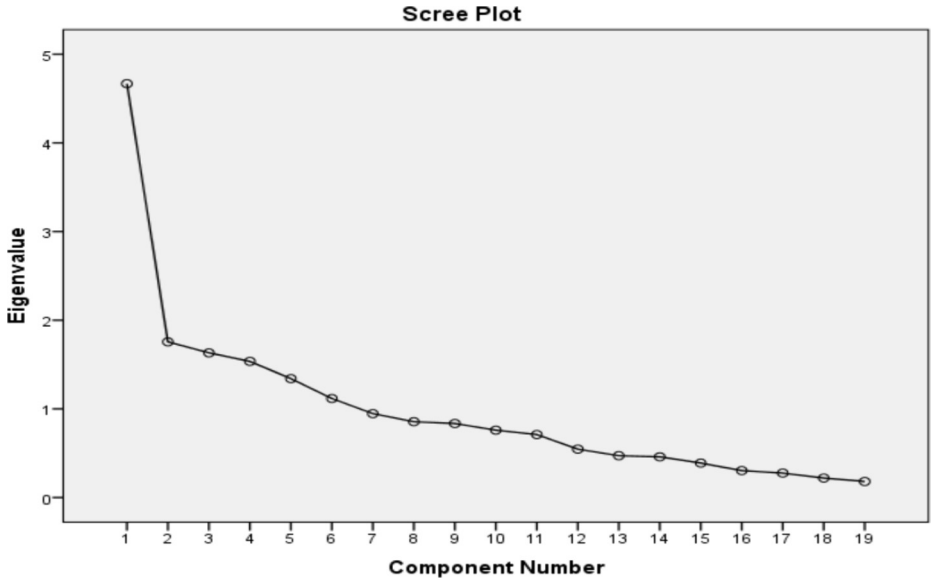

Fig. 1. Scree plot graphic of the scale.

2008). In our study, the factor loadings were quite high (Table 1). This result explained the factorial structure of the scale. The EFA explained 42.4% of all factors in a three-factor structure. An analysis of the results reveals that the first factor is made up of 8 items with item factor loads ranging from 0.763 to 0.474. The second factor comprises 6 items with item factor loads ranging from 0.709 to 0.497, with the third factor comprising 5 items with item factor loads ranging from 0.701 to 0.420. The fact that factor loading for each item is >0.40 indicates strong construct validity. Carpenter (2018) recommends an explained variance range of 0.40–0.60 for multidimensional scales.

Reliability

According to Goodwin and Goodwin (1984), a valid scale must first be reliable. In other words, if a a scale lacks validity, it is not reliable. However, we cannot say that a scale that is not valid cannot be reliable. For this reason, it can be said that the reliability level of a measure should be examined first. In addition, the reliability of a scale refers to the state in which the scale yields the same results when the same behavior is measured repeatedly on the same scale.

Internal consistency, item-total correlation, and split-half method analysis were used to assess the DHLS's reliability. Internal consistency tells us the degree to which each item contained in a measuring tool is consistent with other items on the scale and represents the variable at hand (Alpar, 2016). Cronbach's alpha reliability coefficient is most commonly used to test internal consistency. A Cronbach's alpha value of ≤0.39 suggests that the test that was developed is untrustworthy; values between 0.40 and 0.59 denote low reliability; values between 0.60 and 0.79 indicate high reliability; and values between 0.80 and 1.00 signify high reliability. An alpha value of 0.70 is typically considered an acceptable threshold for reliability but values of 0.80 and 0.95 are considered to be a preferable assessment of the psychometric quality of a scale (Alpar, 2016; Boateng et al., 2018; Kılıç, 2016). Our study's Cronbach's α value of 0.804 demonstrates excellent reliability. However, Table 2 shows that Cronbach's α coefficient varies in the range of 0.761–0.865 in the three subscales. The differences in the coefficients may have stemmed from the difference in the number of items in each subscale since Cronbach's α coefficient tends to increase with the addition of more items (Taber, 2018).

Item-total correlation explains the relationship between the scale scores and the overall scare score. The greater the correlation coefficient, the more the scale displays the ability to effectively and adequately measure the behavior intended to be measured by that particular item. Items with an item-total correlation of 0.30 or above are considered to display good discrimination power between participants; items falling between 0.20 and 0.30 should be tested or modified if they are considered to be relevant. In item selection, acceptable item-total correlation coefficients must be >0.20. Items with low correlation should be removed from the scale (Çokluk et al., 2012) (Table 1). In the analysis in this study of the item total score correlation coefficients of the 19-item DHSL, it was found that the correlation coefficients of the scale items were distributed between 0.301 and 0.782.

The split-half approach is another technique that is used to assess internal consistency reliability. The scale had a total of 22 items originally, but after 3 were removed, the remaining items were split into two groups–the first 10 items forming one group and and the last 9 items forming a separate group. Cronbach's Alpha coefficients in both groups were close to each other and adequately high (Group 1: 0.789; Group 2: 0.728). In such a case, the desired split-half reliability coefficient (Cronbach's Alpha) should be at least 0.70 (Erkuş et al., 2017). Cronbach's Alpha coefficient was above 0.70 in our study (Table 2). Furthermore, the Spearman-Brown (0.77) and Guttman split-half

Table 2
Cronbach's alpha and split-half reliability results of DHLS.

Sub-scales (n = 222)	Items	Cronbach's Alpha Coefficient	Split-half Reliability	
			Spearman- Brown Coefficient	Guttman Split-half Coefficient
To have knowledge about acute complications of diabetes	8	0.776		
Interpret the problems encountered with acute complications of diabetes	6	0.865	0.775	0.754
Healthy lifestyle behaviors related to acute complications of diabetes	5	0.761		
Total scale	19	0.804		

coefficients (0.75) were calculated to determine the reliability of the two halves. The Guttman Split-Half coefficients and the results of the the Spearman-Brown Prophecy Formula yielded adequate values for both halves. It can therefore be stated that the scale items had been arranged consecutively. It was seen that both calculations could be accepted as reliable measurements.

Limitations

A reliability analysis of the test-retest data was not possible since the subjects could not be contacted again. However, in this study only 5 of the paticipants were using insulin pumps. The construct validity of the scale may be evaluated in a different study in a larger sample including children using insulin pumps.

Implications to practice

DHLS can be used to assess the relative strengths and weaknesses of children with diabetes in terms of their health literacy about the acute consequences of their condition. This scale is a useful measurement tool that can be employed especially in the case of children with Type 1 Diabetes to determine the level of a child's diabetes health literacy with regard to the acute complications and emergency situations that may develop in in daily life. We believe that metabolic control can be kept within the target range by reducing the incidence of acute complications in children with diabetes. This will also ensure that the child and family can recognize and manage complications appropriately.

Conclusion

In conclusion, the Health Literacy Scale for Acute Complications of Diabetes for Children with type 1 Diabetes (8–12 years) was found to be a valid and reliable measurement tool.

Ethics committee approval

The Marmara University Institute of Medical Health Sciences Ethics Committee granted ethical permission (Permission Date and Number: 18.01.2021-05).

Informed consent

The hospitals involved provided written consent. After obtaining written informed consent from the children and their families, participants were briefed about the study and asked to complete the DHLS questionnaires anonymously.

Financial disclosure

The authors declared that this study received no financial support.

What is already known on this topic?

- When children with type 1 diabetes have inadequate or limited diabetes health literacy, they face the various negative effects of prolonged hospitalization, an increase in unnecessary health expenditures, increased school absenteeism, and diminished academic achievement.
- Fostering diabetes health literacy is important in terms of providing children with Type 1 diabetes with information, at a level they can understand, about managing the disease, while at the same timeteaching them protective behaviors and implementation skills.
- The absence of a diabetes health literacy scale and low health literacy levels among children are significant risk factors that lead to acute complications that are difficult to manage.

What does this study add?

- The health literacy scale contributes to the literature as a valid and reliable instrument for assessing the health literacy of children with Type 1 diabetes.

CRediT authorship contribution statement

Fatma Yeşil: Writing – original draft, Resources, Data curation. **Çağri Çövener Özçelik:** Writing – review & editing, Writing – original draft, Validation, Supervision, Conceptualization.

Declaration of competing interest

The authors have declared no conflicts of interest.

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We would like to thank all the children who participated in the study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pedn.2024.06.016.

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