Psychometric Assessment of the Diabetes Empowerment Scale among Iranian Adolescents with Type 1 Diabetes

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Abstract

Background
Adverse effects of problems caused by chronic diseases can be reduced by increasing patient empowerment. The aim of the present study was to assess psychometric properties of Gothenburg Young Persons Empowerment Scale (GYPES) among Iranian adolescents with type 1 diabetes.

Materials and Methods: This is an applied descriptive study with psychometric assessment and test validation design. The study population consisted of 150 patients with type 1 diabetes referred to medical centers in Isfahan, Iran. Samples were selected using convenience sampling and based on inclusion criteria. The Persian version of the scale was developed based on the model of the World Health Organization (WHO). The validity of the scale was assessed by calculating the content validity index, face validity, and factor analysis. The reliability of the scale was also assessed by test-retest and Cronbach's alpha test. The collected data were analyzed using SPSS version 21.0 in two descriptive and inferential levels.

Results: The content validity index (CVI) was more than 0.8 for each item except Item 12. Based on the results of exploratory factor analysis (EFA), none of the common values was less than 0.5. The results of Pearson correlation test also showed a positive and significant relationship between the two stages of the questionnaire (P = 0.001). Cronbach's alpha method was used to measure the internal consistency of the whole instrument (0.725), and its dimensions (0.62-0.83).

Conclusion
The 14-item GYPES among Iranian adolescents with type 1 diabetes was approved and has acceptable validity and reliability. Therefore, this scale can be used as a valid tool, in the field of care and research, to empower adolescents with type 1 diabetes.

Key Words: Adolescents, Chronic diseases, Type 1 diabetes, Psychometric assessment.

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1- INTRODUCTION

The health system has faced a significant challenge in the current century due to the increasing number of chronic diseases, the increase in the number of hospital admissions due to these diseases, and the high cost of care and treatment (1), so more than two-thirds of all deaths occur due to one or more of the five chronic diseases, including heart diseases, cancer, stroke, chronic obstructive pulmonary disease, and diabetes (2). Among these, the most common type of diabetes among adolescents is type 1 diabetes affecting one in every 400 to 500 adolescents (3). Diabetes, as a chronic disease that affects a person for a long time, affects all aspects of life. For this reason, the person should acquire the necessary skills and abilities to deal with disease-related problems in order to be less affected by its adverse effects (4). There are more than three million people with diabetes in Iran, which according to WHO, if effective measures are not taken, this figure will reach nearly seven million by 2030 (5).

The annual incidence of type 1 diabetes in Iran is estimated at 3.7 cases per 100,000 people, which may include type 2 diabetes (6). It is an important challenge to control diabetes during adolescence. Adolescents with type 1 diabetes display poorer metabolic control and adherence to treatment regimens than children, which may be related to their physical, mental, and social changes during this period of life. In fact, adolescence is the most difficult stage to control and manage type-1 diabetes, and inadequate self-management increases the risk of short-term and long-term complications (7). Therefore, adolescents with chronic diseases, including diabetes, must be given special attention and skills according to their unique needs and play an active role in various fields, including work, education, leisure, and family formation and strengthen their decision-making

skills, self-sufficiency, and empowerment (8). In this regard, WHO has also supported the development of health policies to increase the empowerment of patients with chronic diseases (9). Patient empowerment is a concept that aims to increase patients' ability, independence, and participation in self-care (10). Numerous researchers have implemented necessary interventions to empower patients with chronic diseases. For example, Abedini et al. (2016) concluded that the empowerment program can improve self-efficacy and self-esteem of patients with artificial heart valve (11). Moin et al. (2015) also revealed that the empowerment program has a positive and significant effect on quality of life among diabetic patients (12).

In this regard, an important issue is that measuring the ability of patients can be helpful in the effectiveness of empowerment programs and increase the productivity of these interventions. Therefore, considering the increasing prevalence of chronic diseases, including diabetes, especially in adolescents and young people in the world and Iran and the need to improve the abilities of this efficient and active group of society to control the disease and self-care, on the one hand, and also considering the fact that there has been no specific and standard scale to evaluate the empowerment of adolescents with type 1 diabetes in Iran, on the other hand, the aim of the present study was to assess psychometric properties of GYPES among Iranian adolescents with type 1 diabetes. This scale was designed and its psychometric properties were assessed by Mora et al. (2018) in Sweden (13). It is hoped that the translation of this scale into Persian and psychometric assessment can provide Iranian researchers with a useful tool to assess the level of empowerment of adolescents with type 1 diabetes or to assess the effect of health care on the empowerment of this group of

patients. The aim of the present study was to assess psychometric properties of Gothenburg Young Persons Empowerment Scale (GYPES) among Iranian adolescents with type 1 diabetes.

2- MATERIALS AND METHODS

2-1. Study design and population

This is a descriptive study focusing on psychometric assessment and test validation of GYPES, Persian version. The study population was selected using convenience sampling method and based on inclusion criteria, which included the individuals aged 14-20 years old, diagnosis of type 1 diabetes by physicians working in related medical centers, patients and their parents' consent to participate in the study, no psychological or physical disorders, and the ability to read and write. Costello et al. (2005) referred to sample-item ratio as the best method to determine the sample size. They believe that it is better to select 10 to 20 samples for each item of the tool (14). Therefore, considering that the number of final items of the tool used in the present study was 14 items, the sample size was considered 150 people.

2-2. Measuring tools: validity and reliability

The chronic diseases empowerment scale (GYPES), was designed to assess empowerment. This scale consists of 5 main components, including knowledge and perception (questions 1-3), personal control (questions 4-6), identity (questions 7-9), decision-making (questions 10-12), and empowering others (questions 13-15). In the present study, a questionnaire related to adolescents with type 1 diabetes was used. To assess the psychometric properties of the GYPES among adolescents with type 1 diabetes, the designers of the questionnaire were first asked for their permission via email. Then, according to the WHO model, these steps were done. The

translation and content validity of the English version of the scale was translated into Persian by two fluent English translators. Persian version of the scale was translated back into English by a fluent Persian and English translator. This version was then sent to scale developers and approved by them. Content validity refers to the extent to which the tool questions represent the content and purpose of the topic (15). Content validity of the questionnaire was examined by a panel of experts that consisted of 40 individuals, including 10 general practitioners, 4 physicians specializing in internal medicine, 3 endocrinologists, 4 pediatricians, 6 faculty members of the School of Nursing, 10 nurses working in diabetes centers, 1 Nutritionist, 1 methodologist, and 1 clinical psychologist.

The original version of the scale and its Persian translation were provided to panel of experts via email one week before the panel. The panel of experts were then asked to comment on the necessity, relevance, and importance of each item of the questionnaire; so content validity index (CVI), and content validity ratio (CVR) were determined. CVI value was calculated based on Waltz and Bausell's method, experts were asked to determine the degree of relevance of each item based on a four-part spectrum, including relevant, needs basic review, relevant but needs review and fully relevant.

If the value of CVI is <0.7, 0.7-0.79, and > 0.79, the item is rejected, reviewed, and approved, respectively (Hyrkas). CVR was also calculated using the Lawshe method. To this end, experts judge the necessity of each item (17), based on the options, "Necessary", "Useful but not necessary" and "Unnecessary". The ratios calculated for each item were compared with the numbers provided by Lawshe, and if the value obtained was greater than the values of Lawshe's table, the content validity of that item was verified. According to

Lawshe's table, the least CVR for acceptability of each item was determined 0.29 for 40 people (Lawshe, 1987).

2-2-1. Face validity

Cognitive interview method was used to assess face validity. Cognitive interview is a qualitative approach that investigates how target group understands, processes, and answers questions of a questionnaire. Therefore, the potential problems of the questionnaire are identified (18). Cognitive interviews were conducted with 20 adolescents with type 1 diabetes. Finally, the data obtained from the interviews were discussed by the members of the research team, and necessary changes were made in the wording of items 2, 3, 9, 10, and 15 where participants had difficulty understanding their meaning, or needed repetition to understand their meaning.

2-2-2. Construct validity

Factor analysis was used to evaluate the construct validity of the Persian version of the scale. For this purpose, the questionnaire was provided to 150 eligible adolescents with type 1 diabetes referred to medical centers in Isfahan. As requested by some parents, the questionnaires were provided to them electronically since the samples were students and it was not possible to complete the questionnaire in person. Factors were extracted based on eigenvalues> 1 and using varimax rotation. There are statistics that can determine and explain the suitability of the data for factor analysis, including the Kaiser-Meyer-Olkin measure of sampling adequacy, and the Bartlett's test of sphericity (19). The significance level of KMO test showed the adequacy of the sample size (KMO=0.744, $X^2=511.252$). The significance level of Bartlett's sphericity test was also significant (P=0.001). None of the items

had a factor loading of 0.5. So, all the items of the questionnaire were analyzed and no item was removed.

2-2-3. Reliability

To determine the reliability of the scale, Cronbach's alpha and test-retest method were used. To implement this method, the Persian version of the scale was completed by 50 adolescents with type 1 diabetes based on inclusion criteria. Two weeks after completing the questionnaire, the samples were contacted again by telephone and the questionnaires were completed after obtaining their consent. The present study has been approved by the Vice Chancellor for Research, Islamic Azad University, Isfahan Branch (Khorasgan) with the code of ethics (IR.IAU.KHUISF.REC. 1398.088).

3- RESULTS

Most of the samples were female and had a mean age of 17 ± 1.94 years. The mean age at the time of diagnosis was 9.19. ± 1.82 years. Most of the samples were studying at secondary school level (39.4%), and had no history of diabetes among their family (68%), and friends (92%). The demographic and clinical characteristics of the participants are shown in **Table.1**.

3-1. Content validity

The CVI and CVR for each item are presented in **Table.2**. According to the results and opinions of the panel of experts (n= 40 people) the value of CVR and CVI is more than 0.29 for all questions (except question 12, which is 0.15 and 0.42, respectively). Since CVR value of this question is less than 0.29; therefore, this question was removed from the questionnaire.

Table-1: Demographic and clinical characteristics of research samples.

Variable	Group	Number	Percentage
Age	14	21	14
	15	20	13.3
	16	18	12
	17	28	18.7
	18	25	16/7
	19	18	12
	20	20	13.3
Gender	Male	79	52.7
	Female	71	47.3
Level of education	Junior High school	35	23.3
	Senior High school	59	39.4
	Universities	35	23.3
	Other	21	14
Age at the time of diagnosis	7	28	18.7
	8	35	23.3
	9	40	16.7
	10	11	7.3
	11	13	8.7
	12	10	6.7
	13	13	8.7
Family history of diabetes	Yes	48	32
	No	102	68
The presence of diabetes in friends	Yes	12	8
	No	138	92
Total		150	100

Table-2: Content validity ratio and content validity index for items.

Row	Items	Total number of participating members	Number of members who chose "Necessary" Option	CVR value	CVI value
1	I know and understand my diabetes.	40	40	1	1
2	I know what I need to do to stay healthy.	40	40	1	1
3	I know when to call my healthcare provider for my diabetes.	40	40	1	1
4	I am skilled enough to manage my diabetes in my daily life.	40	40	1	1
5	I feel in control of my health.	40	40	1	1
6	I am active in maintaining my health.	40	40	1	1
7	Diabetes is a part of me.	40	40	1	1
8	Living with diabetes makes me stronger.	40	40	1	1
9	I have dedicated a place to my diabetes in my life.	40	36	0.8	1
10	I can tell things I care about to my healthcare providers.	40	40	1	1
11	I actively participate in discussions about my health with my health care providers.	40	36	0.8	0.875
12	I can make decisions about my health and healthcare with health care providers	40	23	0.15	0.425
13	I am skilled enough to support other young people with diabetes.	40	40	1	1
14	I can give useful advice to people who are struggling with diabetes.	40	35	0.75	0.875
15	I can help others by sharing my experiences regarding how I keep myself healthy.	40	34	0.70	1

3-2. Exploratory factor analysis

The results of exploratory factor analysis (EFA) of scale items are presented in Tables 3 and 4. The significance level of KMO test showed that the sample size is sufficient (x^2=511.252, KMO = 0.744).

Significance level of Bartlett' test of sphericity was also significant (p = 0.001). None of the items had a factor loading of less than 0.5; therefore, all items of the questionnaire were used in the analysis and no item was deleted (**Table.3**).

Table-3: Bartlett and KMO tests.

KMO measure of sampling adequacy		0.744
Bartlett's Test of Sphericity	Chi-squared test	511.252
	P-value	0.001

Items 1, 2, and 3 were assigned to the third factor called knowledge and understanding (**Table. 4**). This factor explains 22.29% of the variance. Items 4, 5, and 6 were assigned to the second factor, called personal control. This factor explains 14.430% of the variance. Items 7, 8, and 9 were assigned to the first factor, called identity. This factor explains 10.370% of the variance. Items 10 and 11 were assigned to the fourth factor, titled decision-making. This factor explains 9.564% of the variance. Items 12, 13, and 14 were assigned to the fifth factor, titled empowering others. This factor explains 7.909% of the variance.

Table-4: Exploratory factor analysis by principal component and varimax rotation method.

Items	Factors				
	1	2	3	4	5
1. I know and understand my diabetes.			0.773		
2. I know what to do to control my blood sugar.			0.847		
3. I know when to contact my health care providers			0.727		
4. I can continue my daily life with diabetes.		0.783			
5. I feel in control of my health status.		0.756			
6. I try to maintain my health.		0.581			
7. Diabetes is always with me.	0.888				
8. Living with diabetes makes me stronger.	0.817				
9. I have accepted living with diabetes.	0.690				
10. I can ask my important questions from my health care providers.				0.714	
11. I am active in diabetes training classes.				0.851	
12. I can support other teenagers with diabetes.					0.762
13. I can give useful suggestions to teenagers who are struggling with diabetes.					0.812
14. I can help others by sharing my method of controlling my blood sugar.					0.487

3-3. Reliability

The results of Pearson correlation test showed a positive and significant relationship between the two stages of the questionnaire (P = 0.001). Therefore, the reliability of the test was confirmed at this stage (**Table.5**). Cronbach's alpha value of the whole scale was 0.725 and > 0.7 for other dimensions showing the high internal consistency of the questionnaire (**Table.6**).

Table-5: Results of test-retest reliability.

Score obtained in the first stage of the questionnaire	Score obtained in the second stage of the questionnaire	Correlation (R)	P-value
10.852	8.368	0.956	0.001

Table-6: Results of internal consistency reliability (Cronbach's alpha).

Variables	Number of items	Cronbach's alpha
The whole scale	14	0.725
Knowledge and understanding	3	0.625
Personal control	3	0/745
Identity	3	0.730
Decision-making	2	0.811
Empowering others	3	0.834

4- DISCUSSION

Empowerment is considered as the dominant approach in supporting patients with chronic diseases such as diabetes. Empowerment for diabetes management is accomplished through preparation, information, multimedia resources, the use of appropriate technology, and the development of skills in diabetes self-management programs (5). The aim of the present study was to assess the psychometric properties of GYPES among Iranian adolescents with type 1 diabetes. The present study used the most valid content validity methods, namely CVR and CVI. To this end, a panel of 40 experienced experts calculated CVR, CVI, and the face validity of the scale items. Previous studies in Sweden have shown that this scale can be measured and used in education and programs intended to help the transition to adulthood (7, 20, 21). Prior to this research, there was a weak basis for guidelines, recommendations, and strategies for adolescent empowerment; however, this scale can help fill the knowledge gap related to transition to adulthood and empowerment of adolescents with diabetes (7). Researches used GYPES as a tool to empower adolescents with chronic congenital heart disease. They showed a relationship between empowerment with age, quality of life, transition readiness, patient perception, health behaviors, body image, anxiety and treatment of cognitive problems, and relationships with others (20); therefore, adolescents will face fewer problems through empowerment education and interventions intended to help the transition to adulthood and self-care empowerment (22). In the present study, CVR and CVI values for Question 12 of the main scale (I can decide with my healthcare providers about my own health care) were 0.15 and 0.42, respectively. Therefore, this question, which belonged to the decision-making factor, was removed from the decision factor scale based on the Lawshe's method and the rest of the questions were approved. Also, the importance of the Question 12, was not adequate according to the panel of experts. Decision-making refers to a situation in which the patient is so aware of their disease conditions that he/she can provide useful information about their conditions to the physician and assist the physician during the treatment and prepare their psychologically for medical interventions (13). Disapproval of Question 12 of Persian version of this tool could be due to the socio-cultural differences between Iran and Sweden where scale designers live. Since adolescents in Mora et al.'s study have the right to submit medical consent

and make decisions at the age of 13 under national law (13). Controlling diabetes is a difficult and tedious process for children and adolescents of all ages and requires direct and close family supervision, therefore, nursing interventions should focus on the participation of both this group of patients as well as their family (23). However, it should be noted that many patients do not interfere in the process of medical procedures, which is due to their wrong attitude towards the patient's mere obedience to the physician. Despite being aware of their right to choose, they prefer to follow the physician as an omniscient person. However, a large number of patients are also unaware of their right to decide (24). In this regard, it should be said that people's decision-making style can be influenced by their family environment. Nevertheless, empowerment plays an effective role in the decision-making component, because empowered people are aware of their disease and actively participate in the treatment plan, and since some of the most important decisions are made during adolescence, the most appropriate step is to study the decision-making ability and style. However, there are few studies in this area. Other research findings showed that the Persian version of this scale has a good reliability. Cronbach's alpha coefficient was 0.725 for the whole scale and ranges between 0.62-0.83 for its subscales. Also, the results of Pearson correlation test analysis indicate a positive and significant relationship between the two stages of the questionnaire. The Cronbach's alpha coefficient for the whole scale and its subscales in Mora et al.'s study (2018) was 0.858 and 0.609-0.805, respectively. Therefore, this scale can be used as a valid empowerment tool for adolescents with type 1 diabetes. It should be noted that empowerment is very essential since these adolescents will eventually reach adulthood while suffering from their own chronic disease. They will

also face various problems considering the special needs of adolescence and that they experience many changes in the individual and social field at this time. Many of these adolescents will also reach old age due to increased life expectancy. Therefore, empowering adolescents with chronic diseases will increase independence and participation in the treatment process, thereby helping them develop important psychological skills such as self-management and goal setting (20, 25). One of the advantages of this scale compared to the scales used in other studies (5, 26) is that the scores of the subscales, in addition to the total empowerment score, can be calculated in a reliable manner. Also, paying attention to all empowerment aspects is another strength of this scale. One of the limitations of the present study is disregarding the predictive and concurrent validity; therefore, it is suggested that this type of validity be considered in future studies. We also had limitation to compare the results with similar studies considering that there are few studies on psychometric assessment of GYPES in other countries. Since study population was limited to adolescents in Isfahan, the generalizability of the findings will be affected. Therefore, in order to increase the generalizability of the findings, similar studies are recommended in other cities of Iran.

5- CONCLUSION

Results revealed that optimal validity and reliability for 14-item GYPES. This scale consists of 5 main components, including knowledge and perception, personal control, identity, decision-making, and empowering others. These components include all individual and interpersonal dimensions of the patient and can well explain the individual's empowerment. Therefore, the present scale can be used by medical teams, counselors, physicians, and researchers to conduct researches related to the empowerment of

diabetic adolescents and to improve interventions and empowerment programs for this group of patients. It is recommended to assess psychometric properties of GYPES among adolescents with type 1 diabetes living in other cities of Iran as well as those suffering from other chronic diseases.

6- CONFLICT OF INTEREST: None.

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