THE MEDICAL BULLETIN OF
SISLI ETFAL HOSPITAL

DOI: 10.14744/SEMB.2023.70033
Med Bull Sisli Etfal Hosp 2024;58(1):62–67

Original Research

Turkish Validity and Reliability of Comprehensive Diabetes Self-Management Scale

Cigdem Cindoglu,[1] Burcu Beyazgul,[2] Merve Tatligun[1]

[1]Department of Internal Medicine, Harran University Faculty of Medicine, Sanliurfa, Türkiye
[2]Department of Public Health, Harran University Faculty of Medicine, Sanliurfa, Türkiye

Abstract

Objectives: A self-care approach is very important in diabetes management. In this study, it was aimed to make the Turkish validity and reliability of the Comprehensive Diabetes Self-Management Scale (CDSMS), which examines the behaviors of diabetes patients.

Methods: The study is of methodological type. CDSMS, which was translated into Turkish from its original version and tested for language validity, was first included in the pilot application and then in the main study. The validity of the scale was evaluated by the Cronbach's alpha coefficient. Then, a Receiver Operating Characteristic (ROC) analysis was performed to determine the cut off score.

Results: The mean age of the study participants was 57.10 ± 11.20 years and the mean disease duration was 9.96 ± 7.79 years. The internal consistency of CDSMS was 0.73, which was measured using Cronbach's alpha. After the ROC analysis, the optimal cut-point score of CDSMS to predict good glycemic control was determined as 21.17 points.

Conclusion: With this study, it was found that the Turkish version of CDSMS is valid and reliable for use in the Turkish population. It is thought that CDSMS will be beneficial to physicians working in the clinic in terms of showing the disease management skills of diabetic patients.

Keywords: Diabetes control, diabetes scale, reliability, validity

Please cite this article as "Cindoglu C, Beyazgul B, Tatligun M. Turkish Validity and Reliability of Comprehensive Diabetes Self-Management Scale. Med Bull Sisli Etfal Hosp 2024;58(1):62–67".

Diabetes is a chronic metabolic disease characterized by elevated blood glucose caused by insulin deficiency or resistance.[1-3] It may show different clinical manifestations depending on the involvement of the heart, blood vessels, eye, nerves and kidneys.[4] Recent studies have shown that the prevalence of diabetes mellitus (DM) is increasing worldwide; and that diabetes-related deaths and health expenditures expose social, financial and health systems to a considerable burden. Type 2 diabetes is a rapidly growing global health problem. The incidence of diabetes varies depending on age, gender, race, nutritional habits, genetic characteristics, and environmental factors.[5-6] It is also known that diabetes negatively affects the quality of life and adversely affects the individual and societal economy.[7] The burden of disease caused by diabetes continues to increase with approximately 420 million patients worldwide and up to 1.5 million deaths annually.[4] Considering this disease burden, the follow-up of patients and early detection of complications become even more important in terms of disease management. Although glycosylated hemoglobin A1c (HbA1c) is a very important marker in monitoring glycemic control, it has limitations due to fac-

Address for correspondence: Cigdem Cindoglu, MD. Department of Internal Medicine, Harran University Faculty of Medicine, Sanliurfa, Türkiye
Phone: +90 505 228 13 75 **E-mail:** ccindoglu@gmail.com

Submitted Date: August 11, 2023 **Revised Date:** September 13, 2023 **Accepted Date:** October 01, 2023 **Available Online Date:** April 05, 2024

tors such as glycemic variability and the time elapsed in the interval.[8,9] Regular monitoring of blood glucose by the patient himself is known to be beneficial in those who receive insulin therapy, but its role in those not treated with insulin is not clear.[10]

HbA1c and blood glucose level are frequently used in DM treatment and follow-up. However, in recent years, the self-care approach has gained importance in diabetes management along with the follow-up of these monitors. Diabetes control strategies should be based on promoting a diabetes-preventive lifestyle. In this approach, patients actively participate in their own disease management processes with the support and information of health professionals.[11-14] Healthy nutrition training, both in the hospital setting and in the community, is crucial in achieving good glycemic control.[15] Regular physical exercise reduces fat percentage by improving body composition, improves blood glucose control of patients and improves insulin sensitivity.[16,17] Self-monitoring of blood glucose makes a person active in disease management and ensures the safety of patients and glucose control, while at the same time improving quality of life.[18,19] Although there are currently many scales for evaluating self-care practices for diabetes, the number of tools that include all processes in diabetes management and have appropriate validity-reliability is low.[11]

The Comprehensive Diabetes Self-Management Scale (CDSMS) developed by Mikhael et al.[20] consists of 7 dimensions: healthy eating, being physically active, taking medications, monitoring of blood glucose, problem solving, reducing diabetes risks and healthy coping with stress. It is a scale that puts the patient in the center in disease management and has a very high potential to provide benefits in control applications. CDSMS consists of 14 questions in total. CDSMS is also correlated with the HbA1c test, which is a very important marker of glycemic control and plays a key role in diabetes management. In this study, it was aimed to determine the validity and reliability of CDSMS.

Methods

The study is of methodological type. The universe of the study consisted of diabetic patients who applied to the internal medicine outpatient clinic of Harran University Medical Faculty Hospital between 01 July 2021 and 15 October 2021. Male and female diabetic patients aged 18 and over, who agreed to participate in the study and who had no language and communication problems were included in the study. Due to the nature of the study, no samples were selected, and it was planned to reach out to 140 people for the study with an approach of taking a minimum of 5-10 people per question (14 questions) in the system based on the scale validity studies. For the 1st pilot study, where the items of the scale were tested, 100 people were included in the study, and then the main application was completed with 140 people. The questionnaire containing the demographic characteristics of the patients such as age, gender and the questions of the scale was applied to the patients.

The Areas Measured by the Scale Questions and the Scoring System

One item (1) aimed to identify patient behavior during stress, two items (2-13) are used to assess the patient's ability to solve major problems, two items (3 and 4) aimed to identify the extent of doing an exercise, three items (5-7) aimed to identify the extent of healthy eating, one item (8) aimed to identify the extent of medication adherence, four items (9-12) aimed to identify the practices to reduce diabetes risks, one item (14) aimed to identify the extent of blood glucose testing.

The 10 items were designed using multiple choice style with 5 different responses; 4 items (items 11-14) have subquestions with a dichotomous answer. The scoring of all items varies between 0 and 4. While the least appropriate practical answer was given a zero, the answers that provided the optimum application were given a 4 in multiple choice items and 1 in binary questions. The score of the items containing sub-questions was calculated by summing the scores for each of the 4 sub-questions. Items 5, 6, 7, 10, 13D and 14B are calculated inversely.

Item 1: direct score

Item 2 and 13: calculate and then divide by 2

Item 3 and 4: calculate and then divide by 2

Item 5-7: calculate and divide by 3

Item 8: direct score

Items 9-12: calculate and then divide by 4

Item 14: direct score

Language Validity

Necessary permissions were obtained from the developers of the scale for the validity and reliability of the CDSMS.[20] Since language and cultural consistency are important in scale adaptation studies, the questions on the scale were translated from English to Turkish independently by 2 different translation experts. Then, these translations were examined with 3 physicians specialized in the field of endocrinology and a translator, and the translations that were considered to best express the item on the scale were adopted. Then, the final version created in Turkish was translated back into English and verified. An application was

made to test the linguistic validity of the items translated into Turkish, and both the final Turkish version and the original version of the scale were tested in a group of 20 bilingual people. Spearman's rho for the total score of test-retest reliability was 0,98 ($p<0.001$).

For the candidate scale, 100 people were reached out for the 1st pilot study. The suitability of the items was evaluated. Items with an item-total correlation value of less than 0.30 were revised by taking the opinion of experts. In the 1st pilot study, no item removal was performed. Since there was no item with an item-total correlation value of less than 0.20, a second pilot was not needed, and the main study was started.

Statistical Analysis

All data were analyzed using the Statistical Package for the Social Sciences, version 22.0 (SPSS Inc., US). In ROC analysis, HbA1c levels of 6.50 and below were taken as good glycemic control and above as poor glycemic control. Frequency distributions and percentages were used in the presentation of categorical data of the participants included in the study, and mean, median, standard deviation, minimum and maximum values were used in the presentation of numerical data.

Evaluation of Validity

Cronbach's alpha values were used to determine the internal consistency of the CDSMS. A Cronbach's alpha value of more than 0.7 was considered optimum. The value of any corrected item-total correlation which is higher than 0.2 is considered acceptable.[21]

Permissions

This study was ethically approved with the decision of Harran University Faculty of Medicine Clinical Research Ethics Committee. Necessary permissions for the study were obtained from the researchers who developed the original scale. After the necessary information was given to the participants of the study, their verbal and written consents were obtained.

Results

60.7% of the participants in the study were women (140 people in total). The mean age of the patients was 57.10±11.20 (min: 25, max: 82) and the mean duration of illness was 9.96±7.79 (min:1, max:40) years. 50.0% of the patients did not receive any training. When the types of medication they use for diabetes are examined, oral diabetics ranked first with 51.4%. The socio-demographic characteristics of the patients are shown in detail in Table 1.

Table 1. Socio-demographic characteristics of the participants

	n	%
Gender		
Female	85	60.7
Male	55	39.3
Educational level		
None	70	50.0
Primary	39	27.9
Secondary and above	33	22.1
Type of medication		
Oral	72	51.4
İnsulin	41	29.3
Combination	27	19.3

Reliability Analysis

The internal consistency of CDSMS was 0.73 which was measured using Cronbach's alpha. All items had corrected total item correlation more than 0.2 (Table 2). Similar to the original version of the scale, the scale consists of 7 subgroups and can explain 83.36% of the total variance.

The summability of the scale items was evaluated with the Tukey summability test. Since the significance value was $p<0.005$ according to the summability test result, it was concluded that the scale was suitable for obtaining a scale total score by adding up (Table 3). Also, in the same table; It is seen that the items are quite different from each other ($F= 54.25$; $p<0.001$). This result shows that the items in the scale are in a structure to explain at least two different subdimensions. Hotelling's T-square test was used to determine whether the item score averages of the scale items were equal to each other and to determine the response

Table 2. Reliability of CDSMS-TV

Item number	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1	0.352	0.718
2	0.385	0.714
3	0.251	0.733
4	0.376	0.717
5	0.421	0.711
6	0.279	0.725
7	0.353	0.720
8	0.395	0.714
9	0.373	0.716
10	0.250	0.728
11	0.272	0.726
12	0.431	0.709
13	0.440	0.708
14	0.327	0.721

Table 3. Tukey Summability Test

	Sum of Squares	df	Mean Square	F	p
Between People	652.829	139	4.697		
Between Items	883.100	13	67.931	54.255	0.000
Nonadditivity	24.807[a]	1	24.807	20.022	0.000
Within People					
Residual					
Balance	2237.664	1806	1.239		
Total	2262.471	1807	1.252		
Total	3145.571	1820	1.728		
Total	3798.400	1959	1.939		

bias. It was determined that the item averages were different and there was no response bias (whether there was a biased response) (Hotelling T2= 493.55, p<0.001) (Table 4). These values show that when answering the scale items, women did not give a biased response and perceived the items in the same way. Biased responses are an important feature that affects the reliability of the scale.

Concurrent Validity

There was an inversely significant correlation between CDSMS score and HbA1c (Spearman's rho: -0.474, p=0.000). Additionally, there was a significant difference in CDSMS score between patients with different glycemic control (Table 5).

CDSMS Cut-Off Point

ROC analysis showed that area under the curve is 0.694 (p=0.006) and the optimal cut-point score of CDSMS to predict good glycemic control is 21.17 points, this score has 86.0% specificity and 35.0% sensitivity to predict patient with good glycemic control (likelihood ratio 2.57). Further details are given in Figure 1.

Table 4. Hotelling's T-Squared Test

Hotelling's T-Squared	F	df1	df2	p
493.555	34.688	13	127	0.000

Table 5. Relationship between CDSMS-TV values and glycemic control level

	CDSMS-TV score	MWU	p
Good glycemic control	19.27±2.80	674.00	0.006
Bad glycemic control	16.44±4.45		

* CDSMS: Comprehensive Diabetes Self-Management Scale; MWU: Mann-Whitney U testi.

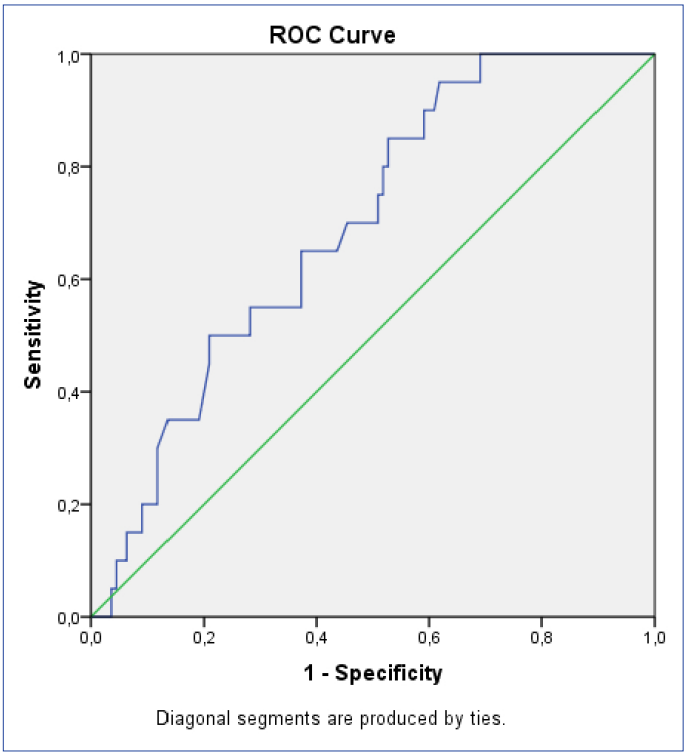

Figure 1. ROC curve for CDSMS score.

Relationship with CDSMS Score and Sociodemographic Factors

The relationship between CDSMS score and socio-demographic characteristics of individuals is shown in Table 6. While CDSMS score was found to be higher in the younger age group, there was no relationship between gender and education.

Discussion

In diabetes management, individual behaviors are as important as monitoring the glycemic status. HbA1c measurement is a method that has limitations due to factors such as

Table 6. Relationship between CDSMS-TV score and socio-demographic factors

Parameters	CDSMS-TV score	MWU	p
Age			
58 years and under	18.25±4.15	1488.50	0.000
Above	15.53±4.21		
Gender			
Female	16.94±4.28	2230.00	0.64
Male	17.05±4.57		
Education			
None	16.42±4.49	2056.50	0.10
Any education	17.56±4.22		

* CDSMS: Comprehensive Diabetes Self-Management Scale; MWU: Mann-Whitney U testi.

glycemic variability and the level it reflects is an average of a period of about 2-3 months.[8,9] The patient's regular monitoring of their own blood glucose is also a method whose role is unclear in those who are not treated with insulin.[10] For this reason, it is clinically important to monitor the CDSMS score, which puts the patient in the center in diabetes management and questions the patient's behavior, together with the glycemic condition. CDSMS consists of 7 subgroups and 14 questions in total. With this study, it was determined that CDSMS-TV can be used as a valid and reliable scale in the Turkish population.

Original scale's internal consistency of CDSMS was 0.70, which was measured using Cronbach's alpha, and Spearman's rho for the total score of test-retest reliability was 0.99 ($p<0.000$), while Cronbach's alpha value of CDSMS-TV was 0.73 and Spearman's rho for the total score of test-retest reliability was 0.98 ($p<0.001$).[20] These results are also very similar to the results of the original version of the scale. Both the original CDSMS and CDSMS-TV Cronbach's alpha coefficient are 0.70 and above, indicating that the construct validity is also sufficient.[22,23]

The relationship between HbA1c, which is measured simultaneously with the application of the scale, and the disease management skills of diabetes patients and the course of blood sugar is examined. This is defined as 'simultaneous validity' in the original scale. As in the original scale, there was an inversely significant correlation between CDSMS score, subgroup scores and HbA1c in CDSMS-TV.[20] This compatibility with HbA1c is a strength of the scale.

In this study, the optimal cut-off point score of CDSMS-TV to predict good glycemic control is 21.17 points, this score has 86.0% specificity and 35.0% sensitivity to predict patient with good glycemic control (likelihood ratio 2.57). This cut-off point can be useful in predicting the course of the disease, treatment and behavior compliance of the patients, need for education, etc., by providing the clinician with a chance to make a preliminary assessment.

Studies show that in patients with diabetes and hypertension, sociodemographic characteristics have significant effects on disease self-management behaviors.[24-26] Indeed, Lu et al.[27] found that those at a younger age and in better economic situation had higher adherence to disease self-management. In this study, it is seen that CDSMS-TV score decreases with increasing age and disease control is better in younger patients. It has been shown that those of female gender are less likely to exercise and maintain exercise, while they are more likely to avoid tobacco and alcohol.[24] Gender and education were not associated with CDSMS-TV score. These results were probably due to the fact that the vast majority of the group was uneducated or under educated.

Conclusion

CDSMS-TV is a valid and reliable scale for use in the Turkish population. CDSMS-TV score below 21 indicates poor glycemic control. CDSMS-TV score can be used in conjunction with basic clinical assessments in patient follow-up because it demonstrates disease management skills of patients.

Disclosures

Ethics Committee Approval: For the study, Ethics Committee of Harran University, Faculty of Medicine approval no 76244175-050.04.04 and dated 09.11.2020.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Consept – C.C., B.B.; Design – C.C., B.B.; Supervision – C.C., B.B.; Materials – C.C., B.B., M.T.; Data collections &/or processing – C.C., B.B., M.T.; Analysis and/or interpretation – B.B.; Literature search – C.C., B.B.; Writing – C.C., B.B.; Critiacal review – C.C., B.B.

References

1. Krau SD. Diabetes: a health threat on the rise. Nurs Clin North Am 2017;52:9–10.
2. Cole JB, Florez JC. Genetics of diabetes mellitus and diabetes complications. Nat Rev Nephrol 2020;16:377–90.
3. Schmidt AM. Highlighting diabetes mellitus: the epidemic continues. Arterioscler Thromb Vasc Biol 2018;38:1–8.
4. WHO. Diabetes. Available at: https://www.who.int/health-topics/diabetes#tab=tab_1. Accessed Oct 02, 2022.
5. Guven Cetin E, Demir N, Kalkan K, Ozturkmen YA, Nazif P, Yildirim Yucelen S, et al. The compatibility of hemoglobin a1c with oral glucose tolerance test and fasting plasma glucose. Sisli Etfal Hastan Tip Bul 2020;54:351–6.
6. Yildiz T, Zuhur S, Shafi Zuhur S. Diabetes risk assessment and awareness in a university academics and employees. Sisli Etfal Hastan Tip Bul 2021;55:524–31.
7. Cannon A, Handelsman Y, Heile M, Shannon M. Burden of illness in type 2 diabetes mellitus. J Manag Care Spec Pharm 2018;24:5–13.
8. Schnell O, Crocker JB, Weng J. Impact of HbA1c testing at point of care on diabetes management. J Diabetes Sci Technol 2017;11:611–7.
9. Shah NA, Levy CJ. Emerging technologies for the management of type 2 diabetes mellitus. J Diabetes 2021;13:713–24.
10. Goyal S, Morita P, Lewis GF, Yu C, Seto E, Cafazzo JA. The systematic design of a behavioural mobile health application for the self-management of type 2 diabetes. Can J Diabetes 2016;40:95–104.
11. Lu Y, Xu J, Zhao W, Han HR. Measuring self-care in persons with type 2 diabetes: a systematic review. Eval Health Prof 2016;39:131–84.
12. Kolb H, Martin S. Environmental/lifestyle factors in the pathogen-

esis and prevention of type 2 diabetes. BMC Med 2017;15:131.
13. Stephani V, Opoku D, Beran D. Self-management of diabetes in Sub-Saharan Africa: a systematic review. BMC Public Health 2018;18:1148.
14. American Diabetes Association. Lifestyle management: standards of medical care in diabetes 2018. Diabetes Care 2018;41 Suppl 1:S38–50.
15. Grégoire J, Philis MG. The nutritional education of patients with diabetes. Soins [Article in French] 2017;62:19–23.
16. Amanat S, Ghahri S, Dianatinasab A, Fararouei M, Dianatinasab M. Exercise and type 2 diabetes. Adv Exp Med Biol 2020;1228:91–105.
17. Kirwan JP, Sacks J, Nieuwoudt S. The essential role of exercise in the management of type 2 diabetes. Cleve Clin J Med 2017;84 Suppl 1:S15–21.
18. Wascher TC, Stechemesser L, Harreiter J; den Ausschuss Leitlinien. Blood glucose self monitoring (Update 2019). Wien Klin Wochenschr [Article in German] 2019;131 Suppl 1:115–8.
19. Deshmukh V, Deshmukh C. Achieving good glycaemic control-effective use of self monitoring of blood glucose (SMBG). J Indian Med Assoc 2012;110:161–3.
20. Mikhael EM, Hassali MA, Hussain SA, Shawky N. Development and validation of a comprehensive diabetes self-management scale. Diabetes Metab Syndr 2019;13:1717–21.
21. Streiner DL, Norman GR. Health Measurement Scales: A Practical Guide to Their Development and Use. 4th ed. New York: Oxford University Press; 2008.
22. Alduraywish AA, Srivastava KC, Shrivastava D, Sghaireen MG, AlSharari AF, Al-Johani K, et al. A countrywide survey in Saudi Arabia regarding the knowledge and attitude of health care professionals about coronavirus disease (COVID-19) Int J Environ Res Public Health 2020;17:7415.
23. Park DI. Development and validation of a knowledge, attitudes and practices questionnaire on COVID-19 (KAP COVID-19). Int J Environ Res Public Health 2021;18:7493.
24. Xie Z, Liu K, Or C, Chen J, Yan M, Wang H. An examination of the socio-demographic correlates of patient adherence to self-management behaviors and the mediating roles of health attitudes and self-efficacy among patients with coexisting type 2 diabetes and hypertension. BMC Public Health 2020;20:1227.
25. Mutyambizi C, Pavlova M, Hongoro C, Groot W. Inequalities and factors associated with adherence to diabetes self-care practices amongst patients at two public hospitals in Gauteng, South Africa. BMC Endocr Disord 2020;20:15.
26. Haung Z, Hong SA, Tejativaddhana P, Puckpinyo A, Myint MNHA. Multiple self-care behaviors and associated factors in community-dwelling patients with hypertension in Myanmar. Nagoya J Med Sci 2020;82:363–76.
27. Lu R, Li Y, Zheng Z, Yan Z. Exploring factors associated with self-management compliance among rural elders with diabetes. Inquiry 2021;58:469580211012491.