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ORIGINAL RESEARCH

Validation of the Greek Version of the Diabetes Management Self-Efficacy Scale (GR-DMSES)

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ABSTRACT

Introduction: Self-efficacy has been found to have a direct relation with self-care in diabetes. Several tools have been developed and used for evaluating self-efficacy of diabetic patients, the most widely used being the Diabetes Management Self-Efficacy Scale (DMSES). The aim of the present study was to translate, culturally adapt, and validate the Greek DMSES (GR-DMSES) in order for it to be used in the ATTICA pilot study of the SmartCare EU-funded project.

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Methods: Using standard procedures, the original version of DMSES was translated and culturally adapted into Greek. Content validity was assessed by an expert panel with the calculation of a content validity index of the overall scale. A convenient sample was recruited to complete the questionnaire. Psychometric testing of the produced instrument included internal consistency test (Cronbach's alpha), construct validity (factor analysis), and stability (intraclass correlation coefficient).

Results: One hundred and sixteen patients, aged 36–86 years, with type 2 diabetes (T2D) participated in the study. There were no items excluded from the original scale after the content validity procedure. The coefficient Cronbach's alpha for the internal consistency was 0.93 and the intraclass correlation coefficient for the stability with a 5-week time interval was 0.87 ($P < 0.001$). Factor analysis yielded four factors related to diet, medical therapy, medication and feet check, and physical activity.

Conclusion: The findings supported that the GR-DMSES was reliable and valid in measuring self-efficacy related to diabetes self-management, thus providing a quick and easy-to-use tool for

health professionals dealing with Greek adults with T2D.

INTRODUCTION

Diabetes mellitus (DM) is among the 10 leading causes of death globally, according to World Health Organization (WHO) data [1]. The prevalence of DM for adults was estimated to be 6.4% in 2010 and is projected to rise to 7.7% by the year 2030 [2]. European data published in 2013, show an 8.5% prevalence of diabetes in the age group of 20–79 years [3]. Consisting an emerging pandemic, diabetes imposes a large economic burden on the individual, the national healthcare system, and the economy [4]. This is not the consequence of just diabetes per se, but also of its complications, which additionally contribute to premature mortality rates, and social and economic burdens [5].

In order to prevent diabetes, manage existing diabetes, and prevent or at least slow down the rate of development of diabetes complications, medical nutrition therapy (MNT) is recommended [6]. MNT consists of healthy eating, regular physical activity, and often pharmacotherapy [7]. These behavioral changes need to be achieved and maintained, given the fact that diabetes is a chronic condition, in order to improve clinical outcomes, health status, and quality of life [8]. In recognition of diabetes being a largely self-managed condition, care for those people is focused on diabetes self-management education and support, and aims at facilitating the aforementioned behavior changes [7, 8]. However, behavioral changes are complex processes that are influenced by various factors,

among which self-efficacy has been identified as a core one [9].

Self-efficacy is a concept introduced by Bandura within the context of social learning theory, which was progressed into the social cognitive theory [10–12]. Social cognitive theory postulates that an individual's behavior is determined by personal, behavioral, and environmental factors [10–12]. These factors are not of equal strength, do not occur simultaneously and the interaction between them differs based on the individual, the particular behavior being examined, and the specific situation in which the behavior occurs [12]. However, humans contribute to their own motivation, behavior, and development due to five capabilities: symbolizing, vicarious, forethought, self-regulatory, self-reflective [11, 12]. Self-efficacy is a major determinant of self-regulation and is defined as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" [13].

In diabetes, self-efficacy has been found to have a direct relation with self-care, in a way that this construct owns the predictability power of self-care behavior [14]. This finding has also been replicated in low-income diabetic populations, where higher self-efficacy has been associated with improved glycemic control, medication adherence, self-care behavior, and mental health-related quality of life [15]. However, even though self-efficacy has been found to positively affect adherence to treatment, mixed results have been presented regarding the impact on clinical outcomes [16–18]. This may be partly attributed to the fact that there is not only one tool available for assessing self-efficacy.

In fact, several tools have been developed and used for evaluating self-efficacy of diabetic patients, the most widely used being the

Diabetes Management Self-Efficacy Scale (DMSES) [19]. This tool was originally developed in 1999 and consists of 20 items that reflect the tasks a person with type 2 diabetes (T2D) has to carry out in the context of managing this condition [20]. These diabetes self-care activities can be grouped as follows [21]:

1. Performing activities essential for the treatment of diabetes (i.e., use of medication, dietary adherence);
2. Self-observation (i.e., of body weight, feet condition);
3. Self-regulating activities (i.e., correction of hypo and/or hyperglycemia).

This original tool consists of four factors: five items in the first factor (nutrition specific and weight), nine items in the second factor (nutrition general and medical treatment), three items in the third factor (physical exercise), and three items in the fourth factor (blood sugar). Two versions of the tool are available, both of them consisting of these 20 items and differing mainly in the responses available. The first one asks the respondent to select from a five-point scale (yes definitely, probably yes, maybe yes/maybe no, probably no, definitely not) the answer that best suits him/her to the question of how convinced he/she is that he/she is able to perform the task described in each item [20]. This version has been translated and validated in Turkish [22] and Iranian [23]. The second version uses an 11-point scale which ranges from 0 (cannot do at all) to 10 (certainly can do) as response options to the statement "I am confident that I am able to…" which ends with each one of the items included in the scale. This version has been adapted for use in China [24] and Australia [25]. In both occasions, response grades are summed to produce a single score for self-efficacy.

In accordance to European data, a 7% prevalence of diabetes is reported for Greece [3], but no tools measuring self-efficacy related to diabetes self-management are available for this population. Therefore, the aim of the present study was to translate and culturally adapt the DMSES into Greek (GR-DMSES) and to test the psychometric properties of the produced instrument in a Greek population of middle-aged and elderly patients with T2D. This validated version of DMSES will be used in the ATTICA pilot of the EU-funded project SmartCare, aiming to investigate whether computer-based self-management support can contribute to improve health outcomes of patients with T2D aged over 50 years. Given the need for a tool suitable for use in the aforementioned study and the high prevalence of T2D in older adults [26], the simplest five-point answer scale [20] was chosen to be translated and validated.

METHODS

To ensure the quality and the efficiency of the adapted instrument in the Greek T2D population, the validation of the GR-DMSES was based on the procedure that has been previously described in the literature [27]. This procedure was accomplished in two phases.

First Phase: Translation, Cultural Adaptation, and Content Validity Measurement

Sample and Setting

A convenient sample of patients with T2D was recruited from the Diabetic Association of Piraeus and Islands in Attica, Greece, and from a public, military hospital in the same area. In total, 150 people were recruited and given a

consent form. To determine the sufficient size of the sample for factor analytic procedures, the following two criteria were used: (1) the sample should have 51 more cases than the number of variables to support Chi-square testing in Bartlett's test of sphericity [28]; (2) the sample should include at least 100 cases and a subjects to variables (STV) ratio should be no less than 5 [29]. One of the authors (VE) collected all the data through face-to-face interviews with the participants, during a week. The information collected was confidential and the study procedures were according to the Declaration of Helsinki of 1964, describing the Ethical Principles for Medical Research Involving Human Subjects, as revised in 2013.

Translation

Given the fact that there is no perfect method for translating an instrument, multiple techniques were used, as proposed for cross-cultural research, namely forward translation, consensus meeting, back translation, and pre-test piloting [30, 31]. Forward translation: two bilingual (Greek and English) translators worked independently to produce a Greek version of the DMSES. Consensus meeting: according to the WHO Scientific Advisory Committee of the Medical Outcomes Trust, the 8th requirement when developing or translating an instrument is the cultural adaption which also involves the revision of the translated instrument by a panel of experts [32]. To resolve any ambiguities and discrepancies between the two forward translated versions and to culturally adapt the instrument, the items were revised from a consensus group. The group consisted of the two forward translators, a third bilingual translator and one endocrinologist. Back translation: the version produced by the group

was then back translated in English by two bilingual translators whose mother tongue is English and who had never before seen the original English version of the scale.

Content Validity

To test content validity, the translated version was sent to a panel consisting of eight experts in the area of diabetes self-management, who were familiarized with the conceptual underpinnings and measurement model of the instrument. This multidisciplinary team comprised three endocrinologists, one diabetes specialist pathologist, two registered dietitians, and two registered nurses. Each of the health professionals were asked to assess the necessity of each item of the instrument through a three-response Likert scale (1 = "necessary", 2 = "useful but not necessary", and 3 = "unnecessary"). A content validity index of individual items (I-CVI) was calculated for each item as well as an overall score; average of the I-CVIs for all items on the scale (S-CVI/Ave) for the GR-DMSES. The I-CVI is computed as the number of experts giving a rating of 1 (thus dichotomizing the ordinal scale into necessary and not necessary), divided by the total number of experts. S-CVI/Ave is computed as the average of the I-CVIs for all items on the scale. According to Davis (1992), a content valid instrument should have a minimum content validity index of 0.80 [33]. During this procedure, item 18 "I am able to visit my doctor once a year to monitor my diabetes", was changed to "I am able to visit my doctor every three months to monitor my diabetes" to reflect local best practice. Additionally, the word "blood" from the phrase "blood sugar" in items 1, 2, and 3, was not translated into Greek at all, as it is not used in every day speaking when someone is referring to blood sugar.

Pre-test Piloting

The instrument was pilot tested with 10 patients with T2D from the Diabetic Association of Piraeus and Islands in Attica, Greece, to ensure that future users will comprehend all questions and procedures [34]. Statement of doubts and suggestions regarding each item of the scale was encouraged by open-ended questions, asked by one of the authors. No difficulties in understanding the items were recorded. Completion of the questionnaire took 6–12 minutes.

Second Phase: Psychometric Testing

Internal Consistency

To determine internal consistency, Cronbach's alpha was used, which is expressed as a number between 0 and 1 [35]. Values that fall between 0.80 and 0.90 are considered a very good indicator [36]. Except for overall alpha, two other indicators are important for internal consistency; corrected item–total correlation and Cronbach's alpha if item deleted. The first indicator is a way to assess how well one item's score is internally consistent with composite scores from all other items that remain. If this correlation is weak (anything less than 0.30 is a weak correlation for item-analysis purposes) [37], then that item should be removed and not used to form a composite score for the variable in question. The other indicator is the resulted Cronbach's alpha if a given item is deleted and it is valuable for determining which of a set of items contributes to the total alpha.

Construct Validity

Construct validity was examined by undertaking Principal-Component Factor Analysis with a varimax rotation. To attain the best fitting structure and the correct number of factors, the following criteria were used: (1)

Kaiser rule, (2) the percentage of variation that is explained, (3) scree plot. According to Kaiser rule [38], the factors that should remain are those with eigenvalue greater than 1.0, since this essentially shows that this value is the amount of variation explained by a factor and the eigenvalue which is equal to 1.0 shows a substantial change. A second selection method based on similar conceptual structure is to retain the number of factors that account for a certain percent of variance extracted. There is no unanimity in the literature regarding the degree of the variance explained needed before the number of factors is sufficient. The majority suggest that 75–90% of the variance should be accounted for [39]; however, some indicate that as little as 50% of the variance explained is acceptable [40], especially when the researcher's goal emphasizes parsimony (explaining variance with as few factors as possible). The third criterion is the Cattell's scree plot, which helps to determine the number of factors seeing the breaking point or elbow [41]. Ultimately, the decision regarding the number of factors to retain should be made based on comprehensibility and interpretability in the context of the research [29].

Additionally, it is determined that only factors with loadings >0.30 were included in each factor. Prior to conducting factor analysis, the following conditions were examined to determine if it was appropriate to continue with the specific analysis: correlation matrix, communalities, reproduced correlations, measures of sampling adequacy (MSA). Kaiser–Meyer–Olkin measure of sampling adequacy (KMO) and Bartlett's test were calculated to evaluate whether the sample was large enough to perform a satisfactory factor analysis. The KMO should be greater than 0.5 to proceed with a satisfactory factor analysis and values greater than 0.8 consist a really good

indicator [38]. The *P* value of Bartlett's test of sphericity (which tests the null hypothesis that the original correlation matrix is an identity matrix) should be significant and lower than 0.05 [38].

Stability

For examining test–retest reliability and stability, 25 participants, randomly selected from the total sample, completed for the second time the questionnaire 5 weeks after the first completion. Based on a code that each respondent had, the respondent's data of the first and second measurement could be detected and matched. Then, by means of the intraclass correlation coefficient (ICC), the test–retest reliability was calculated, with appropriate transformation of data.

Statistical Analysis

Data analysis was conducted using SPSS statistical software version 21 (SPSS Inc., Chicago, IL, USA). All variables of the study were calculated with descriptive analysis including mean, standard deviation (SD), frequency and percentage. The psychometric properties of the GR-DMSES were determined with item analysis, reliability, and validity. Item analysis were conducted with item–total correlations. To test the reliability of the GR-DMSES, internal consistency using Cronbach's alpha for each subscale and the overall DMSES. Construct validity was examined by undertaking Principal-Component Factor Analysis with a varimax rotation. To test stability of the GR-DMSES, test–retest reliability was evaluated using ICC using a two-way random effects model and absolute agreement with a 5-week interval between assessments.

RESULTS

Research Population

From the 150 people initially recruited to participate in the study, only 117 returned completed questionnaires (response rate 78%) and consent forms. One of the questionnaires was excluded due to substantial missing data, thus leaving 116 tools for analysis. This number of participants produced an STV ratio of 5.8. Demographic characteristics of the participants are summarized in Table 1. The age of participants ranged from 36 to 86 years with a mean age of 64.4 years (SD = 10.42). The research group was 41.8% male and 58.2% female. Most of the patients had graduated from high school (33.6%), 30.9% had secondary school education, 25.5% elementary education level, and 10% had university or other education. The majority of patients were married (66.7%), 8.8% were divorced, 6.1% were unmarried, and 18.4% co-habited with someone else. Most of the patients had public insurance (90%), 6.4% had private, and 3.6% had both. The average number of years depicting diabetes duration was 12.9 years (SD = 8.05) ranging from 1 to 38 years.

Content Validity

As it is already mentioned, the translated scale was judged by an expert panel of eight healthcare professionals on relevance and phrasing of the instrument items. S-CVI/Ave for GR-DMSES was computed and found to be 0.85.

Internal Consistency

The GR-DMSES had an overall coefficient alpha of 0.93 (Table 2). The corrected item–total

Table 1 Demographic characteristics of participants

Characteristics	Total sample ($n = 116$)	Retest sample ($n = 25$)
Gender (%)		
Male	41.8	44.0
Female	58.2	56.0
Education level (%)		
Primary	25.5	32.0
Secondary	30.9	12.0
High	33.6	34.0
University	9.1	12.0
Other	0.9	0.0
Family status (%)		
Unmarried	6.1	8.0
Married	66.7	64.0
Divorced	8.8	8.0
Widower	18.4	20.0
Health insurance (%)		
Yes, public	90.0	92.0
Yes, private	6.4	8.0
Yes, both	3.6	0.0
Age (years), mean ± SD	64.4 ± 10.42	64.1 ± 14.05
Disease duration (years), mean ± SD	12.9 ± 8.05	11.0 ± 6.72

SD standard deviation

Table 2 Cronbach's alpha for GR-DMSES ($n = 116$)

	Number of items	Cronbach's alpha
GR-DMSES	20	0.93
Diet (items 4, 5, 9, 10, 13, 14, 15, 16, 17)	9	0.92
Medical therapy (items 1, 2, 3, 6, 18)	5	0.76
Medication and feet check (items 7, 19, 20)	3	0.70
Physical activity (items 8, 11, 12)	3	0.79

GR-DMSES Greek version of the Diabetes Management Self-Efficacy Scale

medical therapy, 0.70 for medication and feet check, and 0.79 for physical activity.

Construct Validity

Regarding the criteria needed to be satisfied in order to proceed with factor analysis, Bartlett's test of sphericity was found to be significant ($\chi^2 = 1041.94$, $P < 0.001$) and the KMO measure of sampling adequacy was found to be acceptable (0.87). Based on the results of these two tests and other conditions which were satisfied (correlation matrix, communalities, reproduced correlations, MSA), it was determined that a factor analysis could be computed on this data set.

The three criteria that were used in order to obtain the best fitting structure and the correct number of factors produced different number of factors. Specifically, components with eigenvalues greater than 1.0, produced five factors, Cattell's scree test plot, indicated four factors (Fig. 1) and the percentage of total variance explained by each factor, revealed at least two factors (Table 4). Due to disagreement

correlations indicated good correlations (different from zero) for all the items. Removal of one or more weakly correlated items did not result in major consequences on the alpha value. The mean corrected item–total correlation for the GR-DMSES was 0.61 (minimum = 0.46, maximum = 0.74; Table 3). Cronbach's alpha coefficients, for each of the subscales identified during construct validity testing of GR-DMSES, were 0.92 for diet, 0.76 for

of methods, four factors were decided to be the optimum solution, based on comprehensibility and interpretability in the context of the research [29]. These four factors explained the 66.2% of the total sample variance.

The principal components that were chosen follow the statement that the first component accounts for the maximum part of the variance which was 43.5% with eigenvalue 8.7 (Table 4). This factor describes the nutritional adjustments a diabetic person is recommended

to do in order to manage the disease. On this factor, loadings are found for items which concern the ability of the patient to follow dietary recommendations when he/she is under specific circumstances, such as being ill, away from home, on holiday, at a party, or in a specific psychological pressure like stress (items 4, 5, 9, 10, 13, 14, 15, 16, 17). The second component explains the maximum part of the remaining variance (9.8%) with an eigenvalue of 2.0. On this factor, loadings are found about

Table 3 Reliability analysis

	Scale mean if item deleted	Scale variance if item deleted	Corrected item–total correlation	Cronbach's alpha if item deleted
DMSES1	40.48	230.419	0.458	0.928
DMSES2	40.33	227.771	0.591	0.926
DMSES3	40.46	228.846	0.602	0.926
DMSES4	40.09	226.658	0.613	0.925
DMSES5	40.04	224.749	0.647	0.925
DMSES6	39.91	226.134	0.517	0.927
DMSES7	40.28	224.467	0.580	0.926
DMSES8	39.85	222.417	0.572	0.926
DMSES9	40.22	223.080	0.732	0.923
DMSES10	40.24	225.444	0.708	0.924
DMSES11	40.05	225.188	0.590	0.926
DMSES12	40.12	223.296	0.639	0.925
DMSES13	39.72	220.848	0.649	0.924
DMSES14	39.80	221.019	0.677	0.924
DMSES15	39.86	217.242	0.745	0.922
DMSES16	39.76	223.182	0.627	0.925
DMSES17	39.40	221.171	0.618	0.925
DMSES18	40.25	229.879	0.473	0.928
DMSES19	40.76	231.849	0.584	0.926
DMSES20	40.41	229.031	0.562	0.926

Cronbach's alpha = 0.929
DMSES Diabetes Management Self-Efficacy Scale

blood sugar control, weight control, and visiting doctor regularly (items 1, 2, 3, 6, 18). The third factor explains 7.4% of the variance with an eigenvalue of 1.5 and has to do with the medication and feet check, including taking and adjusting medication and self-examination of feet (items 7, 19, 20). The last factor explains 5.5% of the variance with an eigenvalue of 1.1. This factor refers to items related to physical activity and it includes three items concerning the ability to take enough exercise, more exercise if doctor suggests that and the ability to adjust eating plan when taking more exercise (items 8, 11, 12). Fourteen items had double loading, but for the majority of them (9 items) the bigger factor loading was kept (Table 5). One item had almost equal factor loadings (ability to adjust eating plan when ill) and in this case the loading taken into account was chosen based on better interpretation of the analysis. The same applied for the remaining four items, which the smaller factor loading was taken into account for the same reason.

Stability

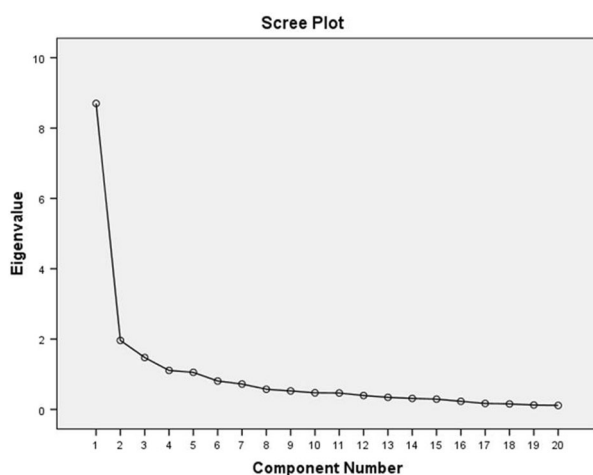Twenty-two percent of the sample was completed the scale for the second time after

Table 4 The results of the Principal-Component Factor Analysis

	Eigenvalue[a]	% of variance	Cumulative %
1	8.701	43.503	43.503
2	1.961	9.806	53.309
3	1.474	7.370	60.680
4	1.108	5.541	66.221

[a] The latent dimension is taken to be equal to the number of eigenvalues which are >1.0

5 weeks from initial approach. ICC was found to be 0.87 (95% confidence interval 0.085–0.965, $P < 0.001$).

DISCUSSION

The objective of this study was to translate, culturally adapt and evaluate the validity and reliability of the DMSES among a Greek population. According to the results of the present study, the items were homogenous to the scale; as the mean and variance scores of each item and item–total correlation confirmed this homogeneity.

The sample size in the present study was larger than that of the Australian ($n = 88$) and Turkish ($n = 101$) validation studies and smaller than that of the Iranian ($n = 332$) and Chinese ($n = 230$) validation studies [22–25]. For sample size determination, all criteria that were suggested in the methods section were satisfied.

The content validity of this scale seems sufficiently secured. Specifically, the S-CVI/Ave score depicted acceptable agreement [42, 43], but was found to be smaller than that calculated in the validation study for the Chinese version (0.86) [24]. In the present study, the expert panel consisted of professionals working with diabetic patients coming from different disciplines

Fig. 1 Scree plot for determination of number of factors

Table 5 Rotated factor matrix of the Greek version of the Diabetes Management Self-Efficacy Scale ($n = 116$)

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1: diet				
4. I am able to choose the correct food	0.566	0.455		
5. I am able to choose different foods and stick to a healthy eating pattern	0.547	0.508		
9. I am able to adjust my eating plan when ill	0.537		0.540	
10. I am able to follow a healthy eating pattern most of the time	0.445	0.668		
13. I am able to follow a healthy eating pattern when I am away from home	0.832			
14. I am able to adjust my eating plan when I am away from home	0.826			
15. I am able to follow a healthy eating pattern when I am on holiday	0.798		0.347	
16. I am able to follow a healthy eating pattern when I am eating out or at a party	0.768		0.387	
17. I am able to adjust my eating plan when I am feeling stressed or anxious	0.684	0.324		
Factor 2: medical therapy				
1. I am able to check my blood sugar if necessary		0.651		
2. I am able to correct my blood sugar when the sugar level is too high		0.358	0.576	
3. I am able to correct my blood sugar when the blood sugar level is too low		0.496	0.620	
6. I am able to keep my weight under control		0.414	0.333	
18. I am able to visit my doctor every three months to monitor my diabetes		0.748		
Factor 3: medication and feet check				
7. I am able to examine my feet for cuts			0.736	0.357
19. I am able to take my medication as prescribed		0.663	0.512	
20. I am able to adjust my medication when I am ill			0.662	
Factor 4: physical activity				
8. I am able to take enough exercise, for example, walking the dog or riding a bicycle			0.302	0.802
11. I am able to take more exercise if the doctor advises me to do so				0.891
12. When taking more exercise I am able to adjust my eating plan	0.389			0.696
Variance explained (%)	43.5	9.8	7.4	5.5

Extraction method: Principal-Component Analysis, rotation method: varimax with Kaiser normalization

(nurses, dietitians, endocrinologists), all being aware that self-efficacy consists a major determinant of self-management. However, there were no self-efficacy experts in the panel as there is no such specialty in Greece.

Reliability of the GR-DMSES was high with a value of 0.93 of the total scale and ranged from 0.70 to 0.92 for the subscales. This is similar to findings reported for the Iranian (0.92), English (0.91), and Chinese versions (0.93), and higher

than the Dutch (0.81) and Turkish versions (0.88) [20, 22–25].

It is of note that the various versions differ in the number of factors revealed. In the present study, four factors were generated, in concordance to the Chinese and Dutch tools [20, 24], whereas in the Turkish version there were three factors [22] and in the Iranian version, five factors [23]. The difference in the number of generated factors between the present version and other versions, could be related either to the various response scales of the instruments or to different sample sizes. The present tool is closer to the original regarding sample size and uses the same response scale, parameters that may explain the fact that in both tools four factors were revealed. Differences were also apparent regarding the content of factors. Factor 1 in GR-DMSES is the same to factor 1 of the Chinese version and similar to the sum of factors 1 and 2 of the Dutch version. Factor 2 in GR-DMSES is similar to factor 2 and two items present in factors 3 and 4 of the Chinese version, and to factor 4 plus two items present in factors 1 and 2 of the Dutch version. Factor 3 is similar to factor 4 of the Chinese version and there is no similarity with any of the factors found in the Dutch version. Finally, factor 4 is similar to factor 3 of the Chinese version, which has an extra item and identical to factor 3 of the Dutch version.

The findings with regard to stability of the instrument, measured with a time interval of 5 weeks, can be judged as excellent good with an ICC of 0.87. This finding on the test–retest reliability indicated good stability of the GR-DMSES according to Rosner's recommendation, who suggested that an ICC >0.75 means excellent reproducibility [44]. This finding is similar to that of the Turkish version of DMSES where the ICC was found to be 0.91. There are two common methods to calculate test–retest reliability: Pearson's product-moment correlation and ICC [45]. However, the Pearson's product-moment correlation, which is used in other studies, has limitations such as an inability to detect a systematic error [45]. On the other hand, ICC has been reported to be a more sensitive method to assess test–retest reliability.

Nevertheless it should be noted that this tool was validated in middle and old age urban convenient population suffering from T2D. This may limit the generalizability of the findings in other age groups or rural populations.

Summarizing, self-efficacy is a major determinant of self-regulation and diabetes consists a highly prevalent, among Greeks, chronic disease demanding self-management. Health professionals are in position to help people with diabetes improve their self-efficacy. However, the first step of nutrition care process, a systematic approach to providing high-quality nutrition care [46], is assessment. Having a validated tool appropriate for the population to assess self-efficacy is really important in the realm of providing the best nutritional support. Moreover, applying an already widely used tool gives the opportunity to health professionals to compare the effectiveness of their intervention, regarding self-efficacy, to that of other studies and further improve their techniques. This study showed that GR-DMSES is a valid and reliable scale and could be used to measure self-efficacy related to diabetes self-management of Greek diabetic patients, thus providing a quick and easy-to-use tool to health professionals dealing with Greek adults with T2D.

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Compliance with Ethics Guidelines. The information collected was confidential and the study procedures were according to the Declaration of Helsinki of 1964, describing the Ethical Principles for Medical Research Involving Human Subjects, as revised in 2013. Informed consent was obtained from all study participants.

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