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Updated Version of Motiva.Diaf-DM2 v2 Questionnaire for the Assessment of Diet and Physical Activity in Patients with Type 2 Diabetes Mellitus

ABSTRACT

Objective: The purpose of this study was to test the psychometric properties of the Motiva.Diaf-DM2 v2 questionnaire that assesses motivation and adherence to healthy eating and physical activity recommendations in patients with type 2 diabetes.

Materials and methods: A cross-sectional study was designed to assess the psychometric properties of the Motiva.Diaf-DM2 v2 study questionnaire. Participants were patients over 18 years old, diagnosed with type 2 diabetes. All participants completed the Motiva.Diaf-DM2 v2 questionnaire and an HbA1c test. Additionally, two weeks after the administration of the questionnaire, 50 patients completed the questionnaire for the retest of the instrument. Factor analysis and coefficients were performed for data analysis.

Results: A total of 220 patients were recruited to the study from primary care, with a mean age of 63.32 years (SD = 9.70) and 38% of the patients were

women. Systematic sampling ($k = 5$) was used to select a random subsample of 44 patients for the retest. The questionnaire consisted of two factors. Both factors showed good internal consistency, $\alpha = 0.781$ and $\alpha = 0.687$ for the first and second factor, respectively. Coefficients were 0.976 for the first factor and 0.999 for the second factor. The results showed that scores for adherence to healthy behaviors had good reliability in terms of internal consistency and temporal stability. **Conclusions:** The Motiva.Diaf-DM2 v2 shows good psychometric properties to be used with primary care patients diagnosed with type 2 diabetes mellitus. (Clin Diabetol 2022; 11; 6: 365–371)

Keywords: type 2 diabetes, diet, exercise, validation

Introduction

Diabetes mellitus is a chronic metabolic disease that is a significant public health problem [1, 2]. A healthy lifestyle that includes a balanced diet, adequate weight loss and increased physical activity levels, are the cornerstones for management and prevention of disease progression in patients with type 2 diabetes [3, 4]. According to Hemmingsen et al. [5], a healthy diet, increased physical activity and a motivated patient are essential to reduce or delay type 2 diabetes complications [6, 7], and help maintain good glycemic control [8] as assessed by glycated hemoglobin levels

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(HbA1c) [8, 9]. In Spain, the third goal of “The Strategy for the Management of Chronic Diseases” in the National Health System highlights the importance of promoting healthy lifestyles. It also establishes primary prevention strategies, as well as promoting and reinforcing capacity development at an individual and community level to promote autonomy, self-care, and healthy lifestyles [10].

Evidence from several studies shows that educational interventions including lifestyle modifications are effective for glycemic control and reducing risk factors [11–13]. However, behaviors must be assessed prior to the intervention, in order to determine individual needs that inform the actions of healthcare providers. Some instruments have been developed for the evaluation of dietary intake and/or physical activity in people with type 2 diabetes. Prior to 2018, there was no tool to assess dietary, basic psychological needs (BPN) and physical activity for type 2 diabetes monitoring in Spain.

Hence, the Motiva.Diaf-DM2 questionnaire [14] was designed and validated specifically for clinical practice. It consists of two sections. The first section includes 20 items that assess adherence to dietary recommendations (14 items) and physical activity (6 items), and the second section includes 12 items that assess BPN as described by Deci and Ryan [15], which is broken down as 6 items for diet and 6 items for physical activity. According to these authors, motivation, and fulfillment of basic needs (competence, autonomy, and social relatedness) are key elements that must be accounted for in the assessment of each patient’s degree of commitment to voluntary actions, such as adopting a healthy lifestyle [16]. Therefore, adhering to a healthy lifestyle and wellbeing are directly related to motivation and the satisfaction of BPN [17].

While the Motiva.Diaf-DM2 questionnaire exhibited strong psychometric properties [14] and potential effectiveness in clinical practice [18], some behavioral recommendations required modification of this instrument. Therefore, the present study was designed with the aim of updating the questionnaire and assessing the psychometric properties of the updated version. The aim was to test the validity and reliability of the Motiva.Diaf-DM2 v2 questionnaire in assessing motivation and adherence to healthy diets and physical activity recommendations in patients diagnosed with type 2 diabetes.

Materials and methods

Design

A cross-sectional study was designed to assess the psychometric properties of Motiva.Diaf-DM2 v2 study questionnaire. The study was conducted in the

Área Sanitaria IV of the Principality of Asturias (Spain) between May and December 2021.

The study was divided into two parts. First, a draft of the updated version of the Motiva.Diaf-DM2 questionnaire was created and evaluated by 11 experts with the aim of determining content validity. Expert experience was considered according to the following two criteria: i) a medical or nursing professional with more than 5 years of experience in primary care; ii) more than 5 years of experience in monitoring adults diagnosed with type 2 diabetes. Psychometric properties were subsequently assessed in the targeted patient population.

Participants

The target study population were patients diagnosed with type 2 diabetes who were being monitored in 3 primary healthcare care centers (PHCs) in the Principality of Asturias. The inclusion criteria were: i) patients of 18 to 80 years of age; ii) being willing to participate in the study and sign the informed consent; iii) being willing to have HbA1c test between May and December 2021 available. Individuals with physical, cognitive or psychological impairment that would prevent them from completing the study were excluded.

Ferrando et al. [19] recommend the selection of 5 to 10 individuals per administered item, or at least 200 participants for psychometric study. Consecutive sampling was used to recruit a total of 250 participants. A systematic sampling method was used for the retest (where $k = 5$), to select 50 participants.

Recruitment and consent process

A virtual meeting with nursing professionals from the PHCs was organized before the beginning of the study to explain the project, the data collection method and to select a collaborating healthcare provider (nurse) for each center. A collaborating nurse would act as a liaison between the potential participants and the research team and introduce the potential participants to the study team.

If a potential participant was interested in the study, the collaborating nurses would explain the study to them. Patients who met the inclusion criteria and agreed to participate in the study would sign the consent form. Once the patients signed the consent form, an HbA1c test would be completed at PHCs; then the patients would complete the questionnaire, which they had to fill in and return to the collaborating nurse before leaving the PHC. The patient’s latest HbA1c level was attached to their questionnaire. Two weeks after the administration of the questionnaires, the 50 patients selected for the retest were contacted

by phone by the research team and given an appointment at their PHC for the retest.

Data collecting and analysis tools

The Motiva.Diaf-DM2 v2 questionnaire was used to collect information about personal, behavioral, dietary, and physical activity variables as well as levels of satisfaction of BPN (autonomy, competence, and social influence). The Spanish version of the Brief Resilient Coping Scale was used to measure resilience [20].

The Motiva.Diaf-DM2 v2 questionnaire was created by taking into consideration the first version of the questionnaire [14]. The questionnaire is composed of three sections. The first section collects sociodemographic, personal and disease data: sex, age, marital status, level of education, cohabitation status (living alone/living not alone), time since type 2 diabetes diagnosis, and type of treatment they are currently undergoing.

The second part includes 20 items, 14 about diet and 6 about physical activity. These items were written with the following structure: "Imagine that both at lunch and dinner time" or "It is recommended...", followed by the question: "do you follow this recommendation?" with 10 response options designed to analyze the motives that better explain the patients' behavior. The first four answers assessed why healthy recommendations were not followed (amotivation): "because I did not know this information", "because I do not find it useful", "because it would be a great effort for me", and "because I cannot". The next four options were related to extrinsic motivation: "Yes, because my family/people around me/my doctor encourages me", "because I feel bad if I don't", "because I know it's good for my health", and "because I have always followed these habits". The last two responses regarded reasons that were related to intrinsic motivation: "Yes, because I enjoy it" and "because it makes me feel good".

A 5-point Likert scale was used for the answers in this second part following motivations described by Deci and Ryan [16] in their self-determination model (range 0 = amotivation to 5 = intrinsic motivation). A dichotomic scale (0 = does not follow recommendation; 1 = follows recommendation) was also used.

The last part of the questionnaire included answers about the level of satisfaction of BPN. It included two items to assess each of the BPN (autonomy, competence, and social relatedness) for diet and physical activity separately, with a Likert-scale range from 0 (never) to 4 (always). The total score for each BPN will range from 0 to 4. This last part was not assessed as it was not modified from the original questionnaire.

The Spanish version of the Brief Resilient Coping Scale questionnaire consists of four Likert-like items from 1 (does not describe me at all) to 5 (describes me very well), with higher scores indicating more resilient behaviors [20]. HbA1c data was retrieved from digital medical records.

Data analysis

A descriptive analysis was carried out for personal variables related to behavioral recommendations, BPN, and analytic parameters. Data was presented in percentage or as a mean score (standard deviation).

Subsequently, an exploratory factor analysis was carried out using the Robust Unweighted Least Squares (RULS) as the estimation method and the Pearson correlation matrix as the starting matrix. The number of factors was determined using the Parallel Analysis method, an optimal implementation method with 5,000 resamples [21]. The following adjustment fits were taken into consideration: Goodness of Fit Index (GFI > 0.9) and the Root Mean Square Error of Approximation (RMSEA < 0.8).

Internal consistency was estimated using Cronbach's Alpha and test-retest reliability was assessed using the Pearson correlation coefficient. Pearson test scores were correlated with the scores measuring BPN regarding diet and physical activity, the Brief Resilient Coping Scale, and HbA1c.

The exploratory factor analysis was performed using Factor Analysis software (version 12.01) and the statistical analyses were conducted using SPSS v.27.0.

Results

Population characteristics

A total of 220 patients participated in the study, with a mean age of 63.32 years [standard deviation (SD) = 9.70]. The sample consisted of 62% men, 79% who were not living alone, and the highest level of education completed was elementary school (73%). The mean time since the diagnosis of type 2 diabetes was 9.11 years (SD = 6.56). A total of 65% used oral antidiabetic drugs and 26% used insulin (Tab. 1). Of the 50 individuals who were contacted for the retest, only 44 completed the retest.

Factors related to adherence to healthy habits

The Kaiser-Meyer-Olkin index test (KMO = .71) and the Bartlett statistic ($p < 0.001$) showed that the data matrix is appropriate. After this first analysis and following the recommendations by Ferrando et al. [19] items 5, 6, 9, 12, 13, 14, and 15 were eliminated from the questionnaire despite having a factorial weight <0.30, finally leaving a total of 12 items in the questionnaire.

Table 1. Basic Characteristics of the Total Population Included in the Study and the Retest

| Categorical variables | Total population (n = 220) | Retest population (n = 44) |
|------------------------------|-------------------------------|-------------------------------|
| Sex n (%) | | |
| Male | 137 (62) | 30 (68) |
| Female | 83 (38) | 14 (32) |
| Level of education, n (%) | | |
| Elementary | 160 (73) | 34 (27) |
| Secondary | 56 (25) | 10 (23) |
| Higher ed. | 4 (2) | 0 |
| Marital status, n (%) | | |
| Single/separated/divorced | 58 (26) | 11 (25) |
| Married or in a relationship | 162 (74) | 33 (75) |
| Cohabitation, n (%) | | |
| Alone | 47 (21) | 11 (25) |
| With other people | 173 (79) | 33 (75) |
| Treatment, n (%) | | |
| Insulin | 57 (26) | 31 (70) |
| Oral antidiabetic medication | 144 (65) | 7 (16) |
| No treatment | 19 (9) | 6 (14) |

The Parallel Analysis method, with 5,000 resamples, recommended extracting only two factors.

The first factor consists of dietary recommendations (8 items), and the second factor consists of behaviors related to physical activity recommendations (4 items). The exploratory factor analysis was repeated, and all factorial weights were > 0.30 (Tab. 2). Adjustment rates showed a relatively adequate adjustment for a bidimensional structure.

Internal consistency and reliability

Internal consistency showed satisfactory values, $\alpha = 0.781$ for the first factor and $\alpha = 0.687$ for the second factor. The test-retest correlation, assessed in a subsample of 44 participants, showed a 0.976 coefficient for the first factor and a 0.999 for the second factor.

Correlation between behaviors, HbA1c, and resiliency

A significant correlation, inverse yet weak, was observed between HbA1c values and adherence to physical activity recommendations ($r = -0.182$; $p = 0.007$). Another significant association, weak or moderate, was observed between reliance and healthy dietary ($r = 0.199$, $p = 0.003$) and physical activity ($r = 0.375$, $p < 0.001$) recommendations, respectively.

Table 2. Factorial Analysis of Scale Adherence to Healthy Behavior

| Adherence elements | Factorial weights | |
|---|-------------------------------|--------------------|
| | Factor 1 | Factor 2 |
| 1 | 0.449 | |
| 2 | 0.675 | |
| 3 | 0.592 | |
| 4 | 0.371 | |
| 7 | 0.391 | |
| 8 | 0.459 | |
| 10 | 0.395 | |
| 11 | 0.373 | |
| 16 | | 0.871 |
| 17 | | 0.820 |
| 18 | | 0.479 |
| 19 | | 0.609 |
| Adjustment rates | GFI = 0.971; RMSEA = 0.076 | |
| Percentage of variance explained | 41.70% | |
| | $\alpha = 0.781$ | $\alpha = 0.687$ |
| | Test-retest | Test-retest |
| Score reliability | $\alpha = 0.976$ | $\alpha = 0.999$ |

GFI — goodness of fit index; RMSEA — root mean square error of approximation

Discussion

The results of this study demonstrated proper psychometric properties of the Motiva.Diaf-DM2 v2 questionnaire, with the appropriate internal consistency and temporal stability of the instrument. This updated version allows the assessment of the adherence to recommendations regarding a healthy diet and physical activity in patients diagnosed with type 2 diabetes.

Other instruments have been developed for the evaluation of dietary intake and/or physical activity in people with type 2 diabetes. We observe concordance in the adequate psychometric properties, that are easy to use and theory based [22, 23]. Additionally, a key point to highlight is that there is no other questionnaire existing in Spanish and developed in Spain, other than Motiva.Diaf-DM2, which is specific for type 2 diabetes and reflects Spanish Culture. This includes behaviors, diet and physical activity, the motivation to develop the behaviors and the basic psychological needs. As it is well known, the evaluation of dietary intake and physical activity is essential because it allows the development of personalized interventions focused on improving both behaviors in people with type 2 diabetes.

Promoting a healthy lifestyle, including diet and physical activity, in individuals diagnosed with type 2 diabetes is essential for good outcomes and the prevention of potential complications [24]. The systematic review by Wee et al. [25] highlights the importance of assessing patient-reported outcomes related to lifestyle, self-care, self-efficiency, psychosocial impact, and empowerment in this population. Indeed, patients can report this type of information in the Motiva.Diaf-DM2 v2 questionnaire, which highlights its feasibility for clinical practice.

Another important aspect of version 2 which also highlights its potential for clinical practice is the questionnaire's capacity to assess BPN and motivation for each recommendation. This can help estimate stability of adherence, as shown by Ryan and Deci [17] and by Prochaska and DiClemente [26]. The questionnaire also helps guide the type of behavioral management, which should be different for each patient.

The fact that the Motiva.Diaf-DM2 v2 identifies behavioral characteristics, as well as type of motivation and fulfillment of BPN, will allow nurses and healthcare providers who monitor patients with type 2 diabetes to focus their interventions on each person's specific needs. Person-centered healthcare results in feelings of security and individual control of health; therefore, people tend to be more effective, leading to longer-lasting changes over time [27]. As recommended by the WHO [28], health education should include these learning opportunities presented voluntarily and include not only knowledge but also the development of personal abilities, fostering motivation and self-esteem too. Behavioral interventions must transmit knowledge, and they must assess autonomy and motivation in people to develop healthy behaviors, essential for individuals to play an active role in the control of their own disease too [29].

In contrast with version 1, where suggested servings were expressed in grams to estimate adherence to healthy diet recommendations, forcing the patient to weight each serving of food [14], this second version preferred the Harvard Healthy Eating Plate [30]. Furthermore, nutrition and diabetes experts tend to agree on the convenience of using this method, because it is simpler and more accessible, and it has a positive effect on adherence to dietary recommendations when used in learning interventions [31]. Additionally, we would like to highlight the reduction in items. Motiva.Diaf V1 included 20 items while the second version includes 12 items, which speeds up and reduces the duration of questionnaire completion [14].

HbA1C was used as an external validity measure which is a direct indicator of healthy diet and physical

activity [13]. An inverse and significant relationship was observed between adherence to physical activity and HbA1c. Reduced HbA1c is only associated with a combination of diet and physical activity interventions [32]. Hence, it is important to assess both behaviors as the updated instrument. The meta-analysis by Huang et al. [13] concludes that interventions including both diet and physical activity behaviors have a broader impact on the reduction of cardiovascular risk than interventions that focused only on physical activity, as life-style interventions decrease HbA1c, HDL, arterial pressure and body mass index.

The appropriate psychometric properties of the questionnaire have also been verified with the direct relation observed between resilience and behavioral recommendations. Previous research has shown a direct and significant association between lifestyle and resilience in individuals diagnosed with type 2 diabetes [33].

The associations, both physical activity with HbA1c and resilience with behaviors, showed weak or moderate significance, which warrant future studies to clarify this association. A greater number of participants and populations with greater adherence to behavioral recommendations are needed.

Implications for diabetes care and education specialists

The Motiva.Diaf-DM2 v2 questionnaire is a quick and easy-to-use tool that will allow healthcare providers who monitor patients with type 2 diabetes to assess adherence to healthy diet and physical activity recommendations. These assessments will result in patient-care individualized interventions. The Motiva.Diaf-DM2 v2 questionnaire could potentially play an important role in the clinical practice. It could be used in the first contact of the professional with the person diagnosed with type 2 diabetes. It could enable the professional to know what behaviors can be improved and on what basic psychological needs they must act upon. In other words, it is useful to develop a personalized intervention, adapted to the specific behaviors and needs of the patient. Additionally, it could be used later to evaluate the effectiveness of these interventions, as it was assessed in the pilot of the first version of this questionnaire [18].

Limitations

It is important to take into consideration how different cultures and the environment determine behaviors, especially the ones included in the Motiva.Diaf-DM2 v2 questionnaire. Therefore, the items in this questionnaire should be revised if the questionnaire were to be used in populations with sociocultural

characteristics affecting dietary habits that may differ from the ones included in the questionnaire. The heterogeneity that characterizes the Spanish language must also be taken into consideration, as it could lead to biased interpretations of the content, therefore requiring special attention before using the questionnaire in populations in which the bias could be present.

Conclusions

The results of the present study demonstrated the validity and reliability of the Motiva.Diaf-DM2 v2 questionnaire to assess motivation and adherence to healthy diet and physical activity recommendations in individuals diagnosed with type 2 diabetes.

Compliance with ethical standards

This study was approved by the Ethics Committee of the Principality of Asturias, Spain (reference number: 2021-320).

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Conflict of interest

None declared.

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