Empowering Patients for Healthy Nutrition, Physical Activity, and Self-Care Using the Diabetes Score Questionnaire

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Keywords
Diabetes mellitus · Patient education · Behavior change · Lifestyle modifications · Self-management

Abstract

Objectives: Lifestyle factors such as nutrition and physical activity play an important role in the management of diabetes mellitus. Unfortunately, adherence to lifestyle change remains low among patients with diabetes. The aim of this study was to evaluate the effectiveness of the Diabetes Score questionnaire in a clinical setting.

Methods: The Diabetes Score is a 10-item shared decision-making tool designed to empower lifestyle change in individuals with diabetes. It yields an intuitive score from 0 to 100 based on a patient’s adherence to lifestyle recommendations. An observational study was conducted at an ambulatory health care center. After obtaining written informed consent, adult patients with type 2 diabetes mellitus were interviewed by a trained researcher using the Diabetes Score questionnaire. Patients’ Diabetes Score values were analyzed in reference to their glycemic control and other clinical and demographic factors.

Results: A total of 60 individuals with type 2 diabetes participated in the study. The mean age was 56 years (minimum 43 years, maximum 70 years) with 60% being males. Higher Diabetes Scores correlated with better glycemic control (hemoglobin A1C; $r = -0.23$, $p = 0.044$) indicating the effect of lifestyle factors such as healthy nutrition, smaller portion sizes, active lifestyle, and aerobic exercise. The questionnaire showed internal consistency (alpha 0.66), construct validity, and high patient satisfaction (98%).

Conclusion: Diabetes Score, a behavioral lifestyle questionnaire, correlates with glycemic control in type 2 diabetes. Diabetes Score can be used in clinical settings for measuring, discussing, and setting targets for lifestyle change among patients with diabetes.

Introduction

Type 2 diabetes mellitus is primarily a lifestyle condition. Diabetes is influenced by lifestyle and in turn affects the quality of life. Modifiable lifestyle risk factors are important in diabetes care as they are independently associated with diabetes [1]. Thus, a holistic approach to diabetes care is needed in which patients are empowered to make lifestyle changes. By itself, pharmacologic management does not ensure improvement in long-term patient-oriented outcomes such as the quality of life or all-cause mortality. Additional nonpharmacologic interventions are needed to empower individuals to improve their quality of life [2]. Yet, a majority of these individuals remain nonadherent to lifestyle guidelines [3].
The Diabetes Score questionnaire is a behavior change tool designed to improve lifestyle factors such as diet and exercise in individuals with diabetes (online suppl. material; for online suppl. material, see www.karger.com/doi/10.1159/000519225). This instrument consists of 10 questions pertaining to physical activity, nutrition, and self-care. Each question is rated by patients on a scale from 0 to 10 points based on the level of adherence. A total score (ranging from 0 to 100) is obtained by adding the points from the 10 individual questions. The questionnaire has been carefully designed for clinical use. All items are actionable and behaviorally oriented. Thus, items that cannot be changed directly by patients themselves, such as blood glucose levels or BMI, are excluded. This is in contrast to the traditional biomedical approach to self-management, which has failed to yield meaningful results [4]. Previous research has shown that knowledge of glycemic control and recommended targets does not translate into lifestyle change [4–6]. One study concluded that “Strategies to provide information to patients must be combined with other behavioral strategies to motivate and help patients effectively manage their diabetes” [6].

All regions of the world are experiencing an epidemic of obesity and type 2 diabetes [7]. Diabetes tends to be underdiagnosed and undertreated [8]. Patients’ knowledge about diabetes and self-management remains low [9]. Glycemic levels are suboptimally controlled despite advances in diabetes therapy [10]. There is an urgent need for a practical, low-cost patient decision aid for diabetes self-management. We aimed to evaluate the Diabetes Score questionnaire in a clinical context. In particular, we sought to assess whether Diabetes Score correlates with better glycemic control among adult patients with diabetes.

### Materials and Methods

#### Study Design

A cross-sectional questionnaire survey was conducted at a primary care clinic in the city of Al Ain, United Arab Emirates, in 2018. Researcher-administered structured brief interviews were conducted with otherwise healthy, community-dwelling, adult individuals with type 2 diabetes in an ambulatory setting.

#### Study Sample

Inclusion criteria for recruitment of subjects in the study were age 18 years or greater and an established diagnosis of type 2 diabetes mellitus. Exclusion criteria included any mental or hearing deficits and other severe medical conditions such as mobility restrictions that would impede participation in the study. A minimum sample size of 47 subjects was deemed sufficient to detect a correlation of 0.4 between Diabetes Score and hemoglobin A1C (power 80%, 2-tailed alpha 0.05).

### Results

A total of 60 adult patients with type 2 diabetes mellitus participated in the study. The sample was representative of a wide range of diabetic patients (Table 1). The ages ranged from 43 to 70 years (mean 56; standard deviation [SD], 5.7). Males constituted 60% of the sample. A broad

### Table 1. Characteristics of study participants

| Characteristic                  | n (%) (n = 60) |
|--------------------------------|----------------|
| Age, years                     |                |
| <50                            | 11 (18.3)      |
| 50–59                          | 33 (55.0)      |
| 60 or more                     | 16 (26.7)      |
| Gender                         |                |
| Males                          | 36 (60.0)      |
| Females                        | 24 (40.0)      |
| Education                      |                |
| Primary                        | 5 (9.4)        |
| Secondary                      | 22 (41.5)      |
| College                        | 26 (49.1)      |
| BMI, kg/m²                     |                |
| Normal, <25                    | 2 (3.6)        |
| Overweight, 25–29              | 30 (53.6)      |
| Obese, ≥30                     | 24 (42.9)      |
| Glycemic control (A1C), %      |                |
| Controlled, <7                 | 42 (75.0)      |
| Mildly elevated, 7–8           | 11 (19.6)      |
| Uncontrolled, >8               | 3 (5.4)        |

#### Data Collection

A trained researcher (H.M.) conducted all the interviews to ensure consistency and reliability. Patients in the clinic waiting area were offered information about the study, and voluntary informed consent was requested. Preprinted questionnaire forms were used to collect data in a structured format. The primary outcome measure was the level of correlation between glycemic control (HbA1c) and the patient’s Diabetes Score. Demographic (age, gender, occupation, and education) and clinical (weight, recent blood glucose, and HbA1c) data were recorded. Additionally, patients’ satisfaction with Diabetes Score was assessed by asking their perceptions and whether they would use the questionnaire in the future.

#### Statistical Analysis

Statistical data analysis was conducted using the current version of SPSS Statistics (version 26; IBM SPSS Inc., Armonk, NY, USA). In addition to descriptive measures, statistical tests for bi-variate correlation, t test, and multivariate regression were performed. Reliability analysis was assessed using the alpha (Cronbach) model. Factor analysis was used to evaluate principal components (subcales) for diet, exercise, and self-care. An alpha level of 0.05 was considered statistically significant.
range of occupations (electricians and engineers to farmers and carpenters) and educational backgrounds (mean years of formal education, 13; SD, 2.6) was present. Most (70%) patients were diagnosed within 10 years and about one-fourth were suboptimally controlled with a hemoglobin A1C >7% (53 mmol/mol).

The mean Diabetes Score was 55.1 points (SD, 17.8) in this sample. Patients were more adherent to dietary items than to exercise or physical activity (Fig. 1). The correlation with hemoglobin A1C was −0.23 (p = 0.044), indicating that higher Diabetes Scores were associated with better glycemic control. Diabetes Score correlated with BMI (r = −0.37, p = 0.003) and education (r = 0.22, p = 0.049) but not with age or duration of diabetes. There was no significant difference between male and female patients in terms of glycemic control (A1C 6.8% vs. 6.9%;

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**Table 2. Clinical associations of Diabetes Score**

| Characteristic                  | Participants with better Diabetes Score (>55 points), n = 25 | Participants with worse Diabetes Score (≤55 points), n = 35 | p value |
|---------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|---------|
| Age, years                      | 55.96                                                       | 56.0                                                        | 0.98    |
| Formal education, years         | 13.3                                                        | 12.9                                                        | 0.56    |
| Weight, kg                      | 86.5                                                        | 91.1                                                        | 0.17    |
| BMI, kg/m²                      | 28.2                                                        | 30.0                                                        | 0.04*   |
| Blood glucose, mg/dL            | 130                                                         | 132                                                         | 0.84    |
| Recent hemoglobin A1C, %        | 6.5                                                         | 7.0                                                         | 0.04*   |
| Duration of diabetes, years     | 9.7                                                         | 7.3                                                         | 0.11    |

* A statistically significant difference on the t test.

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**Fig. 1.** Self-rated scores for the 10 items of the Diabetes Score questionnaire in patients with diabetes (n = 60).
Participants were divided into 2 groups: those with a Diabetes Score $>55$ points (indicating better adherence to lifestyle recommendations) and those with $\leq 55$ points (suboptimal adherence). Comparison of these 2 groups showed that better Diabetes Scores were associated with significantly lower BMI and improved glycemic control (Table 2). On multivariate analysis using multiple linear regression with HbA1C as the outcome variable, none of the variables including Diabetes Score, age, duration of diabetes, education, or BMI were statistically significant predictors of glycemic control (adjusted $R^2 = 0.051$). A refined model showed that age and Diabetes Score were weak predictors (adjusted $R^2 = 0.104$; for Diabetes Score: $F = 2.9, p = 0.093$).

The questionnaire data were analyzed for reliability and acceptability. Reliability analysis for internal consistency yielded a Cronbach alpha of 0.66 for the 10 items. Factor analysis (using varimax rotation) revealed well-separated subscales for diet and exercise with eigenvalues explaining 19% and 20% of variance, respectively. Patient satisfaction with Diabetes Score was also assessed: 98% of participants indicated that the questionnaire was okay, good, or better, while 38% would use it in the future.

**Discussion**

Diabetes Score was associated with better glycemic control among adult patients with type 2 diabetes. The questionnaire showed fair evidence of construct validity, internal consistency, reliability, and patient satisfaction. Previous studies have used a similar cross-sectional study design to assess diabetes questionnaires [11–13].

We found that patients were more likely to comply with dietary guidelines than with exercise. This is consistent with previous research showing the impact of diabetes on the ability to exercise [14]. Foot care was often neglected, indicating an area for self-improvement. The rate of obesity (40%) in our study sample was lower than the rate observed in patients with diabetes elsewhere [15]. Self-reported adherence to diabetes medications was high in our survey indicating awareness of its importance. However, the goal of diabetes education is not merely to increase patients’ knowledge but rather to empower patients to make lifestyle changes. Knowledge of diabetes self-management has tended to remain low despite counseling by dieticians and diabetes educators [9]. In resource-limited settings such as developing countries, where the largest numbers of diabetes patients reside, frequent blood tests and physician visits may not be feasible. Innovative approaches are needed to focus on low-cost, nonpharmacological interventions such as lifestyle change [16].

Previous diabetes questionnaires have tended to be lengthy and complicated, making them unsuitable for use in clinical settings [11, 13]. Many questionnaires were designed for gathering data for research purposes, rather than for improving patient care. Thus, a questionnaire is needed that can be used not only for measuring adherence to diet and exercise but also for discussing targets and monitoring progress. Unfortunately, many questionnaires include items that are not directly modifiable or actionable. Some items are not evidence based such as frequent checking blood glucose in type 2 diabetes controlled with oral medications. The Diabetes Score questionnaire fills this critical gap. It is
a brief, behavioral checklist designed specifically to empower patients to take control of their lifestyle. The 10 items in the questionnaire are simple and actionable. The questionnaire is easy to score, and its results are intuitively understandable (unlike other questionnaires with complicated scoring). Despite widespread efforts at diabetes education in clinics and the community, most patients do not receive adequate instruction [3]. Diabetes Score is designed to be used as an educational tool during counseling by a healthcare professional. Physicians and nurses can engage patients, set targets, and measure progress using Diabetes Score. It can thus form a component of a comprehensive chronic disease care process (Fig. 2). By focusing on patient empowerment, Diabetes Score can be a part of a holistic framework for diabetes care [16].

The study was limited by the context of a single clinic located in an urban setting. Language may be an issue as some patients had limited literacy. However, a bilingual researcher experienced in this setting conducted the interviews. On multivariate modeling, Diabetes Score did not reach statistical significance (\( p = 0.09 \)) as a predictor of glycemic control. Further studies using a prospective study design are needed to confirm these findings.

**Conclusion**

The Diabetes Score is a brief, behavioral questionnaire for lifestyle self-management in diabetes. Results from this study indicate that higher Diabetes Score correlates with better glycemic control. The questionnaire has favorable internal consistency and reliability. It appears to be useful for discussing and promoting healthy nutrition, increasing physical activity, and engaging in self-care among adult patients with type 2 diabetes.

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**Statement of Ethics**

The study was approved by the Al Ain Medical District Human Research Ethics Committee (Ref: DT/bb/15-21; 10-05-2015). Written informed consent was obtained from the participants, and no personally identifiable information such as names or addresses was recorded. Financial incentives were not provided to the subjects for participation in the study. The study was carried out in accordance with the Helsinki Declaration Principles. The safety, privacy, and voluntary participation of subjects were respected at all times.

**Conflict of Interest Statement**

The authors have no potential conflicts of interest to disclose.

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**Data Availability Statement**

Data that support the findings of this study are available from the corresponding author upon reasonable request.

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