The relationships between variables of glycated hemoglobin and diabetes distress in patients with type 1 and type 2 diabetes mellitus

Abstract. Background. Diabetes distress is among potential barriers for people with diabetes mellitus (DM) to reach glycemic goals. Accumulating evidence suggests diabetes distress may be linked to individuals’ emotion regulation capacities. The purpose of this study was to explicate the relationships between variables of glycated hemoglobin (HbA1c), diabetes distress, emotion regulation, and self-care variables through the analysis of cross-sectional data from individuals with type 1 and type 2 DM. Materials and methods. We used structural equation modeling to assess the cross-sectional relationships between variables of HbA1c, diabetes distress, emotion regulation, and self-care variables through the analysis of cross-sectional data from 132 individuals with type 1 and type 2 DM. After giving informed consent for their data to be used for research purposes without identifying them, study participants were examined by clinical psychologists with a structured clinical assessment and a series of other assessments relevant to DM. Results. While participants with type 2 DM differed from those with type 1 DM in terms of age, duration of DM, insulin dependence, and self-care, no significant differences were observed between the groups in sex, HbA1c levels, diabetes distress, emotion regulation-experience, or emotion regulation-skill scores. Study examined two potential explanatory models with one of them showing a more comprehensive view of the data revealing a total effect of poor emotional regulation on HbA1c levels. Diabetes distress in adults is linked to increased negative emotionality (emotion regulation-experience) and reduced skill at emotional regulation (emotion regulation-skill), both of which are associated with elevated HbA1c levels, and these relationships are stronger than those in diabetes self-care. Conclusions. This study suggests that in people with DM, elevated HbA1c levels and diabetes distress are linked to poor emotion regulation. These data emphasize that targeting difficulties in emotion regulation may hold promise for maximizing improvement in diabetes distress and HbA1c in individuals with DM.

Keywords: diabetes distress; glycated hemoglobin; emotional regulation; diabetes self-care

Introduction

Diabetes mellitus (DM) affects over 1.3 million Ukrainians and is currently one of the leading cause of death [1]. The Russian invasion of Ukraine on February 24, 2022, has displaced more than a quarter of the population. Assessing disease burdens among displaced people is instrumental in informing global public health and humanitarian aid efforts. Among displaced Ukrainians authors estimated that more than at least 615,000 have DM [2].

Despite advances in medication and device technology, less than 50 % of people with DM achieve a glycemic target of glycated hemoglobin (HbA1c) < 7.0 % [3]. One potential barrier to glycemic management is diabetes distress, the emotional distress associated with living with DM. The term diabetes distress first entered the psychosocial research vernacular in 1995, and refers to the negative emotional or affective experience resulting from the challenge of living with the demands of diabetes [4]. Diabetes distress...
is common, with nearly 42% reporting elevated diabetes distress scores, is inversely related with both quality of life and DM self-care behaviors and manifests an independent association with HbA1c, over time [5, 6].

Options for treating diabetes distress have traditionally included diabetes education and psychological interventions based on cognitive behavioral therapy, typically targeting depressive symptoms [7] even though diabetes distress is only modestly associated with depression scores [8]. These approaches have resulted in only modest effects on HbA1c levels.

Emotional regulation consists of the experience, processing, understanding, and coping with emotion [9]. Problems in emotion regulation are manifest by feeling too much (or too little) emotion in response to daily life events, and/or in the reactivity/lability of emotion referred to as emotion regulation-experience. Difficulty in identifying, evaluating, and controlling the expression of emotion in an appropriate manner is referred to as skill in emotion management. Emotion regulation-experience and emotion regulation-skill are inversely related, and the presence of poor emotion regulation-skill increases as emotion regulation-experience since the sub-optimal degree of emotion regulation-skill cannot “reign in” the experience of negative emotion [10].

A relationship between emotion regulation and glycemic management is supported by studies on the impact of emotional states, and chronic stress on circulating glucose levels [11]. Recent studies in individuals with type 1 DM and type 2 DM report significant correlations with measures of negative emotional experience and skill at modulating negative emotion [12].

In a larger sample, E.F. Coccaro et al. have shown that poor emotion regulation is strongly associated with diabetes distress [13]. An explicit focus on emotion regulation skills may improve outcomes for diabetes distress interventions.

To date only the T1-REDEEM study in individuals with type 1 DM included a psychological intervention involving an explicit focus on emotion management [14]. While it yielded a large reduction in diabetes distress (d = 1.06) it was only associated with a small relationship between change in diabetes distress and HbA1c (r = 0.14, p = 0.01).

The purpose of this study was to explicate the relationships between variables of HbA1c, diabetes distress, emotion regulation, and self-care variables through the analysis of cross-sectional data from individuals with type 1 and type 2 DM.

**Materials and methods**

One hundred and thirty-two participants were recruited from individuals with type 1 and type 2 DM receiving care at the Ukrainian Scientific and Practical Centre for Endocrine Surgery, Transplantation of Endocrine Organs and Tissues of the Ministry of Health of Ukraine between September 2022 and June 2023. After giving informed consent agreeing that their data would be used for research purposes without identifying them, study participants were evaluated by clinical psychologists with a structured clinical assessment and a series of other assessments relevant to DM. The study was approved by the Ukrainian Scientific and Practical Centre for Endocrine Surgery, Transplantation of Endocrine Organs and Tissues of the Ministry of Health of Ukraine Review Board.

Three items from the Diabetes Distress Scale [13] and three from the Problem Areas in Diabetes Scale [16] and were used to screen for diabetes distress. This screen demonstrated very good internal consistency (α = 0.89) and correlated significantly with a quality of life measure (r = −0.41, p < 0.001) as does the full Diabetes Distress Scale.

Both studies included a questionnaire related to diabetes self-care which was assessed with the Self-Care Inventory-Revised (SCI-R) [17]. The SCI-R is a 15-item questionnaire, scored on a 0–4 Likert scale (ranging from “never” to “always”), assessing diabetes self-care in the past one to two months.

Four questionnaires related to negative emotionality and skill at regulating negative emotion were used in this study. Negative emotionality was assessed with the six-item Negative Emotional Intensity, scale of the Affect Intensity Measure (AIM) [18] and the eight-item Anxiety-Depression Lability scale form the Affect Lability Scales (ALS) [19].

Study involved a descriptive analysis, and a comparison of two hypothesized models. For the descriptive analysis, a negative emotion regulation-experience variable was crea-

---

**Table 1. Characteristics of study participants with type 1 and 2 DM**

<table>
<thead>
<tr>
<th>Variables</th>
<th>DM patients (n = 132)</th>
<th>Type 2 DM (n = 72)</th>
<th>Type 1 DM (n = 60)</th>
<th>P (type 2 DM vs. type 1 DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographic variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, years</td>
<td>49.3 ± 18.3</td>
<td>59.1 ± 11.2</td>
<td>32.8 ± 9.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sex, % female</td>
<td>69.7</td>
<td>66.7</td>
<td>73.3</td>
<td>0.480</td>
</tr>
<tr>
<td><strong>Diabetes-related variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HbA1c, %</td>
<td>7.8 ± 1.7</td>
<td>7.6 ± 1.7</td>
<td>8.2 ± 1.6</td>
<td>0.537</td>
</tr>
<tr>
<td>DM duration, years</td>
<td>11.2 ± 4.8</td>
<td>14.5 ± 6.3</td>
<td>7.3 ± 2.4</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Insulin therapy, %</td>
<td>12.9</td>
<td>23.6</td>
<td>100.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diabetes Distress Scale</td>
<td>6.6 ± 5.9</td>
<td>6.7 ± 5.4</td>
<td>6.3 ± 4.2</td>
<td>0.514</td>
</tr>
<tr>
<td>Diabetes Self-Care (SCI-R)</td>
<td>49.8 ± 9.1</td>
<td>48.2 ± 8.3</td>
<td>51.9 ± 8.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Emotion regulation variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global negative emotionality</td>
<td>32.4 ± 8.3</td>
<td>32.6 ± 8.4</td>
<td>32.4 ± 9.5</td>
<td>0.410</td>
</tr>
<tr>
<td>Global emotional skills</td>
<td>46.2 ± 8.4</td>
<td>45.7 ± 8.2</td>
<td>46.7 ± 8.6</td>
<td>0.565</td>
</tr>
</tbody>
</table>
Table 2. Zero-order correlations for poor emotion regulation, Diabetes Distress Scale, diabetes self-care, and HbA1c

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Poor emotion regulation</th>
<th>Diabetes Distress Scale</th>
<th>Diabetes self-care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Distress Scale</td>
<td>0.42 (p &lt; 0.01)</td>
<td>-0.14 (p = 0.06)</td>
<td>-0.23 (p &lt; 0.01)</td>
</tr>
<tr>
<td>Diabetes self-care</td>
<td>-0.17 (p = 0.04)</td>
<td>0.33 (p &lt; 0.01)</td>
<td>-0.04 (p = 0.639)</td>
</tr>
<tr>
<td>HbA1c</td>
<td>0.04 (p = 0.639)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results

One hundred and thirty-two adults took part in this study. The sample was split between those with type 2 (n = 72) and type 1 (n = 60) DM and their characteristics are listed in Table 1. While participants with type 2 DM differed from those with type 1 DM, in age, years with DM, insulin dependence, and self-care, no significant differences were observed between the groups in sex, HbA1c levels, or in diabetes distress, emotion regulation-experience, or emotion regulation-skill scores.

Zero-order correlations suggested highly significant, medium-sized, relationships between poor emotional regulation and diabetes distress and HbA1c, and between self-care and HbA1c levels (Table 2).

Discussion

A linear model from poor emotional regulation to elevated diabetes distress, to reduced self-care, to elevated HbA1c levels is a viable model for the relationship between these variables and HbA1c. Our results are replicative of the same model tested with T1-REDEEM study data which reported coefficients of 0.36 from “poor emotion management” to diabetes distress, 0.19 from diabetes distress to “skipped insulin boluses”, and of 0.23 from “skipped boluses” to HbA1c [14].

These findings are consistent with previously reported relationships between HbA1c and measures reflective of skill at emotion regulation in adults with type 2 and type 1 DM [11, 13] as well as results from another small study reporting reductions in HbA1c levels in adults with type 2 DM using a group emotional regulation skill behavioral therapy-based intervention [20].

In addition to what improved emotion regulation skill might do in reducing glucose levels, enhancement of emotion regulation skill may also lead to a more healthy psychological state enabling adults with type 2 DM to better use positive coping strategies to improve glycemic management.

A limitation of our study is that it is a cross-sectional study and inferences from the model-fitting analyses and need to be confirmed in a longitudinal study.

Conclusions

Diabetes distress in adults is linked with heightened negative emotionality (emotion regulation-experience) and reduced skill at emotional regulation (emotion regulation-skill) in adults, both of which are related to elevated HbA1c levels and that these relationships are stronger than that with diabetes self-care.

These data suggest that diabetes distress and HbA1c may be improved, especially, in those with DM and difficulties with emotionality.

References

Взято з тексту: Вплив незадоволеної емоційної регуляції, вираженої через високий рівень HbA1c, на диабетичний дистрес та соціальну підтримку у дорослих з цукровим діабетом 1-го та 2-го типів.

Оригінальні дослідження / Original Researches

Information about authors

Pankiv Volodymyr, MD, DSc, Professor, Head of the Department of Prevention, Treatment of Diabetes and Its Complications, Ukrainian Scientific and Practical Centre for Endocrine Surgery, Transplantation of Endocrine Organs and Tissues of the Ministry of Health of Ukraine, Kyiv, Ukraine; e-mail: Endocrin@ua; https://orcid.org/0000-0002-9520-9530

Yuzvenko Tetyana, MD, PhD, DSc, Professor, Deputy Director for Research, Ukrainian Scientific and Practical Centre for Endocrine Surgery, Transplantation of Endocrine Organs and Tissues of the Ministry of Health of Ukraine, Kyiv, Ukraine; https://orcid.org/0000-0003-4229-2075

Conflicts of interests. Authors declare the absence of any conflicts of interests and own financial interest that might be construed to influence the results or interpretation of the manuscript.

Information about funding. This work was supported by the Ministry of Health of Ukraine (“Management of Diabetes Under Conditions of Chronic Stress”; state registration number 0123U100395).

Received 02.08.2023
Accepted 02.10.2023