The Benefits of Cognitive Behavioral Therapy (CBT) on Diabetes Distress and Glycemic Control in Type 2 Diabetes

Seyed-Reza A¹, Norzarina MZ¹, Kimura LW²

¹Universiti Sains Malaysia (USM), Penang Island, Malaysia
²INTI International College Penang, Penang Island, Malaysia

Abstract

Introduction: This study was designed to determine the effectiveness of combined group Cognitive-Behavioral Therapy (CBT) in improving diabetes distress and glycemic control among 60 adults with type 2 diabetes. Methods: Half the participants were the experimental group (n = 30), and the other half was the control group (n = 30). Group therapy consisted of eight sessions for three months. Measures obtained at pre-test and post-test included the Diabetes Distress Scale (DDS-17) and blood examination to examine the level of HbA1c. Result: The results indicated that group CBT had significant effects on the amelioration of diabetes distress and level of HbA1c among the participants of the experimental group. Conclusion: The effectiveness of group CBT in the maintenance of good diabetic control in people who are suffering from type 2 diabetes was successfully demonstrated.

Keywords: Glycemic Control, Diabetes Distress, Cognitive Behavioral Therapy, Malaysia

Introduction

The Malaysian Diabetes Registry Database in 2008 announced that Malaysia would have 2.48 million cases of diabetes by 2030, with a prevalence of 10.8%, a 164% increase from the recorded 0.94 million cases in 2000¹. However, Malaysia had already exceeded that level by 3.6 million cases in 2013². Diabetes is difficult to manage by sufferers for many reasons. Major change of lifestyle and daily decision-making impose a strict discipline on a diabetes patient; they need to carefully control their regimen and sometimes greatly alter their daily activities such as eating, sleeping, and physical activities. Another less obvious reason is that diabetes is related to stress and stress acts directly on metabolic control and insulin metabolism³. An indirect effect of this link is interference with the diabetic patient's self-care tasks³, which means that in order to control diabetes; a patient must be able to reduce stress.

Some research carried out on stress reduction has indicated positive effects in lowering levels of HbA1c, as well as in handling depression and anxiety in patients with Type 1 diabetes⁴. CBT approaches have been found to have a significant effect.
in reducing blood sugar levels in patients with Type 2 diabetes\textsuperscript{5,6}, yet others found no significant change in the level of HbA1c after CBT. However, improvements in well-being, levels of distress and depression were found to result from CBT approaches\textsuperscript{6, 7}. Overall, therefore, there are some encouraging findings concerning the usefulness of CBT in diabetic control and in the reduction of stress.

Despite the urgency of tackling the surging rate of diabetes 2 in Malaysia, to date there has not been any intervention focusing on the psychological complications of diabetes targeting patient coping skills through individual cognition and behavior\textsuperscript{8, 9, 10}. However, one study recognized the vital importance of a diabetes strategy that relies more on the psychological complications of diabetes and the need to understand the patient's knowledge about the disease in order to affect self-management of diabetes\textsuperscript{11}.

**Methods**

**Design**
The quasi-experimental research consisted of a $2 \times 2$ (Therapy $\times$ Control) design. The two experimental conditions were: (1) group CBT and (2) control group. Assessments took place at pre-treatment and post-treatment sessions.

**Subjects**
The sample consisted 60 adults, (39 males, 21 females), aged from 30 to 65 years old, and a majority were married ($n=57; 95\%$). Patients were referred to this research by the Pusat Sejahtera (Universiti Sains Malaysia Clinic), Penang, Malaysia, where they were receiving treatment. Participants must have been diagnosed with type 2 diabetes at least one year prior to this research and were excluded if there was a history of a psychological problem (e.g. major depression disorder, mania, etc.), bereavement or grief reaction during the prior three months. In terms of ethnicity, more than half ($n=35$) were Malay (58\%), eight were Chinese (13.3\%), fifteen were Indian (25\%), and two were foreign (3.3\%). The participants were between 50 to 59 years (46.7\%). About half of the participants ($n=33, 55\%$) were currently employed; 14 (23.3\%) were unemployed (e.g., housewives) and 13 (21.7\%) were pensioners. Participants were at the following income levels: eight (13.3\%) at RM 400-999, 21 (35\%) at RM 1,000 - 2,999, twenty (33.3\%) at RM 3,000-5,999, and 11 (18.3\%) at RM 6,000 or more (Table 1).

**Table 1. Demographic Variables of Participants**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>40-49</td>
<td>11</td>
<td>18.3</td>
</tr>
<tr>
<td>50-59</td>
<td>28</td>
<td>46.7</td>
</tr>
<tr>
<td>$\geq$ 60</td>
<td>19</td>
<td>31.7</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
<td>35</td>
</tr>
<tr>
<td>Male</td>
<td>39</td>
<td>65</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>2</td>
<td>3.3</td>
</tr>
</tbody>
</table>


The current study was comprised of 60 participants, the accepted standard for a quasi-experimental study being a minimum of 30 with 20-25 participants for each independent variable\textsuperscript{12}. Thirty were assigned to the experimental group, and the other thirty to the control group. The therapist started the therapy with three experimental groups of 10 participants each, but after several sessions some participants quit necessitating a call for more participants to form a fourth group.

**Measures**

Diabetic control was measured by level of HbA1c. An HbA1c higher than seven means that one has a greater chance of developing complications associated with diabetes, and conversely, a low level can improve one’s chances of staying healthier\textsuperscript{13}. The recommended level of HbA1c by the Ministry of Health in Malaysia (2010) for type 2 diabetes is ≤ 6.5%\textsuperscript{14}. The level of diabetes distress was determined by administering the Diabetes Distress Scale (DDS-17)\textsuperscript{15}.

**Assessment sequence**

The process of data collection was divided in two phases. Phase one involved interviews to investigate inclusion and exclusion criteria in adults with diabetes and in the second phase, group CBT was applied those willing to join the program for the entire three months. Eight therapy sessions were conducted for four experimental groups. In the first month there were weekly sessions and the rest were once every two weeks. The level of HbA1c and DDS-17 were measured at two different times for all participants: once before entering the therapy (pre-test) and once after finishing therapy (post-test).

**Therapy procedure**

The entire intervention program consisted of eight sessions: the first four were conducted weekly and the subsequent four were conducted fortnightly. In the experimental groups, 10 participants were assigned to the first group; of these six participants (three females, three males; five Malay and one Indian) completed the program. In the second group, 8 out of 10 participants completed the program (three Indians, one
Chinese and four Malays; 1 female, 7 males). In the third group, 8 out of 10 participants completed (four Malays, two Indians and two Chinese; 2 females, 6 males). In the fourth group, 8 out of 10 participants completed the program (three Malays, five Indians; 6 females, 2 males). In the present study, 10 participants failed to complete the group therapy. The Malaysian Ethical Committee of the Malaysian Ministry of Health approved procedures for the study.

**Group CBT**

The favorable impact of group CBT was evaluated in a quasi-experimental design over a period of three months. Our CBT approach, incorporated (i) effective components of cognitive therapy (e.g., cognitive-restructuring technique, stress management or problem-solving), (ii) blood sugar and food monitoring, and (iii) patient education supplements. The focus of the researcher's intervention was to help participants learn to pay attention to their own dysfunctional cognitions and behavior through stimulating the reaction of their conscious awareness about their concepts, beliefs, and thought processes and the overall way they deal with diabetes. By becoming fully aware of their dysfunctional cognitions and behavior, they could then be guided to gradually control and decrease them, and this in turn would cause their metabolic control, distress and active coping to improve. A group setting was utilized to encourage attendance and participation, give mutual support, model successful examples, and exchange experiences and opinions.

**Statistical analysis**

The statistical model used to test the effect of the intervention was a mixed between-within ANOVA. The experimental and control groups served as the between-group factor, and diabetes distress and HbA1c levels before and after therapy served as the within-group factor. The statistical package software SPSS version 20 was used to analyze the distracted data from the current research and 5 percent significance level was considered acceptable for evaluating parameter impacts.

**Results**

Before analyzing the data the normality of the sample was examined using the Kolmogorov-Smirnov (K-S) test. The results of the K-S test for the mean differences in blood sugar level (HbA1c) scores were 0.09, with a p value of 0.20, and the results of the K-S test for the mean differences in the Diabetes Distress Scale (DDS-17) scores were 0.09, with a p value of 0.97. Hence the results revealed that the sample of the current study was distributed normally.

To rule out any pre-existing differences in the blood sugar levels of experimental and control groups prior to the intervention, an independent sample t-Test was conducted to examine the blood sugar levels (HbA1c) in the experimental and control groups before therapy. The means and standard deviations of the HbA1c levels for the experimental and control groups are shown in Table 2.

| Table 2. t-Test Results of the HbA1c in the Experimental and Control Groups at Pre-Test |
|-----------------------------------------------|--------|-------|---|----------|-----|
| Experimental group                          | 30     | 8.66  | 0.62 | 0.93     | 0.35 |
| Control group                               | 30     | 8.81  | 0.61 |          |      |
As can be seen, since there was no significant difference between the scores of the experimental and control groups \((t(58) = 0.93, p = 0.35\) two-tailed\), the participants in the experimental and control groups had similar blood sugar levels (HbA1c) before therapy.

To examine whether the changes in blood sugar levels over time (pre-test to post-test) were different in the two groups (experimental and control groups), the researcher measured the interaction effect, which is the effect of group therapy on blood sugar level which depended on the time and group. The mixed between-within subjects ANOVA showed a significant interaction between group (experimental and control groups) and time (pre- and post-test) that influenced blood sugar levels (Wilks’ Lambda = 0.58, \(F(42, 48) = 41.89, p < 0.01\)). The obtained Partial Eta Squared value \(\eta^2\) was 0.41. According to the commonly used guideline (small effect = 0.01, moderate effect = 0.06 and large effect = 0.14) proposed by Cohen (1988) and Pallant (2010), this result suggests a very large effect size\(^{17, 18}\).

The means before and after therapy in the experimental group showed a 1.33-unit difference, from 8.66 before therapy to 7.33 after therapy, which means that the blood sugar level decreased after therapy. Similarly, the mean before and after therapy in the control group showed a 0.04-unit difference, from 8.81 before therapy to 8.77 after therapy, which indicated that it remained almost the same over time (Table 3).

Table 3. HbA1c Scores across Two Time Periods

<table>
<thead>
<tr>
<th></th>
<th>Experimental group ((n = 30))</th>
<th>Control group ((n = 30))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(M)</td>
<td>(SD)</td>
</tr>
<tr>
<td>Pre-test</td>
<td>8.66</td>
<td>0.62</td>
</tr>
<tr>
<td>Post-test</td>
<td>7.33</td>
<td>1.06</td>
</tr>
</tbody>
</table>

To rule out any pre-existing differences in the level of diabetes distress between the experimental and control groups, an independent sample \(t\)-Test was conducted on the pre-test diabetes distress scores. The mean and standard deviation scores for diabetes distress for the experimental and control groups are shown in Table 4.

Table 4. \(t\)-Test Results of Diabetes Distress in the Experimental and Control Groups at Pre-Test

<table>
<thead>
<tr>
<th></th>
<th>(n)</th>
<th>(M)</th>
<th>(SD)</th>
<th>(t(58))</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
<td>30</td>
<td>2.96</td>
<td>1.01</td>
<td>0.94</td>
<td>0.34</td>
</tr>
<tr>
<td>Control group</td>
<td>30</td>
<td>2.75</td>
<td>0.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The independent sample \(t\)-Test revealed that there was no significant difference in diabetes distress between the experimental and control groups \((t(58) = 0.94, p = 0.34\) two-tailed\), in other words, participants in both groups showed the same level of diabetes distress before therapy sessions. To find out whether the changes in the level of diabetes distress over time were different in the two groups (experimental and control groups) due to the group therapy intervention, the interaction effect between time and group on the level of diabetes distress was assessed. The mixed between-
within subjects ANOVA showed a significant interaction between group (experimental and control) and time (pre- and post-test) that influenced the level of diabetes distress, (Wilks’ Lambda = 0.78, $F(16, 10) = 16.03, p < 0.01$). The Partial Eta Squared value ($\eta^2$) was 0.21, which is considered a very large effect size.

The level of diabetes distress in the experimental group before and after therapy showed a 0.78-unit difference, from 2.96 before therapy to 2.18 after therapy, which means that the level of diabetes distress decreased after therapy. Similarly, the means before and after the therapy in control group showed a -0.11-unit difference, from 2.75 before therapy to 2.86 after therapy, indicating that the level of diabetes distress increased after the same duration of time (Table 5).

Table 5. Diabetes Distress Scores across Two Time Periods

<table>
<thead>
<tr>
<th></th>
<th>Experimental group (n = 30)</th>
<th>Control group (n = 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Pre-test</td>
<td>2.96</td>
<td>1.01</td>
</tr>
<tr>
<td>Post-test</td>
<td>2.18</td>
<td>1.10</td>
</tr>
</tbody>
</table>

The mixed between-within subjects of ANOVA also tested the differences in diabetes distress subscales for the experimental and control groups before and after therapy. There were significant improvements among diabetes distress subscales (emotional burden, physician-related distress, regimen-related distress and interpersonal distress) across time. The results are summarized in Table 6.

Table 6. Means and Standard Deviations for Emotional Burden, Physician-Related Distress, Regimen-Related Distress, and Interpersonal Distress at Pre-Test and Post-Test

<table>
<thead>
<tr>
<th>Subscales</th>
<th>Experimental (n = 30)</th>
<th>Control (n = 30)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td></td>
<td>Pre-test</td>
<td></td>
</tr>
<tr>
<td>Emotional burden</td>
<td>3.25</td>
<td>1.12</td>
</tr>
<tr>
<td>Physician-related distress</td>
<td>3.20</td>
<td>1.45</td>
</tr>
<tr>
<td>Regimen-related distress</td>
<td>3.18</td>
<td>1.19</td>
</tr>
<tr>
<td>Interpersonal distress</td>
<td>2.69</td>
<td>1.14</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td></td>
</tr>
<tr>
<td>Emotional burden</td>
<td>2.50</td>
<td>1.17</td>
</tr>
<tr>
<td>Physician-related distress</td>
<td>1.88</td>
<td>1.21</td>
</tr>
<tr>
<td>Regimen-related distress</td>
<td>2.26</td>
<td>1.23</td>
</tr>
<tr>
<td>Interpersonal distress</td>
<td>2.09</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Discussion

Our study showed a significant decrease in blood sugar level (HbA1c) after therapy among the participants in the experimental group, but no statistical difference in post-test blood sugar level (HbA1c) among the participants in the control group. The
decrease in blood sugar level following therapy in the experimental group demonstrated the effectiveness of group CBT in the improvement of glycemic control. This was consistent with the results obtained by previous studies\textsuperscript{19,6,20}.

Improvement of blood sugar level in experimental group members could be due to several factors, one of which is the important educational component in our CBT intervention. There was a rapid increase in knowledge about diabetes, as experimental group members received informative notes regarding different aspects of diabetes in each session of therapy, which they were expected to study and apply.

Another factor explaining the lowering of blood sugar levels is likely to be the daily monitoring of food by participants in the experimental group, who had to monitor their food and blood regularly as an assigned "homework" or hands-on task. This practice of giving attention to eating more appropriate foods, linked to the knowledge of its benefits, gave them clear reasons why they should eat in more appropriate ways.

The positive social influence impact of group CBT was a strong motivating factor encouraging patients to strive to reach the desired blood sugar level each day. The opportunity to share with other CBT group members gave support and also brought admiration if any member had improved on a particular day. Participants with lower blood sugar level became well-known faces and received more positive reinforcement in therapy sessions from their peers.

Due to the homogeneity of participants in group therapy sessions, participants felt less inferior, which encouraged them to participate more, and this in turn, also played a role in increasing adherence, specifically in control of blood sugar level. Overall, as explained by Yalom and Leszcz (2005), being with others in a group contributes to better therapeutic changes. For example, members can share their feelings (catharsis) and knowing others are like them (universalization); participants can assist others with their work and can be made to feel useful (impacting information, providing feedback, and altruism)\textsuperscript{21}.

The present research showed that the level of diabetes distress was significantly lower among participants in the experimental group after the 12 weeks program compared to before treatment and to the control group. Our findings were similar to those of Peyrot and McMurry (1992) and Henry et al. (1997) whose research revealed lower levels of distress after CBT therapy\textsuperscript{22,23}. What can account for this lowering of distress is first of all, being aware of it via the CBT homework assignments and "stress log sheet", which allowed patients to note the external causes of stress, the specific coping mechanisms they used to deal with it, and to evaluate whether their chosen way was the best or not, all before a public audience, their peers, which added the social reinforcement dimension. It was clear that in stressful situations where the stressor had high personal relevance, individuals less frequently perceived favorable coping options and tended to overuse emotional reserves (emotion-focused coping) rather than focus on strategic plans geared towards implementing a course of action to cope effectively with the situation (problem-focused coping).

Concerning the several determinants of diabetes-related distress which are crucial in managing diabetes (i.e. emotional burden, physician-related distress, regimen-related distress, and internal distress), the mean of emotional burden subscale decreased in the
experimental group after the 12 weeks program. This indicates that after therapy, the participants in the experimental group were more satisfied and felt less overwhelmed by their diabetes in comparison to before therapy. Since emotional burden is one of the strongest factors in self-healthcare behavior for diabetic patients, reducing emotional burden is vital to improving self-care behavior so important in diabetes management.

In addition, the mean of physician (or therapist)-related stress was also lower after the CBT group therapy sessions. Lee and Lin (2009) reported that trust between patient and physician was one of the most important factors in successful control of sugar level, and the stronger the relationship, the greater the likelihood of high self-confidence which is associated with self-supportive behavior and better treatment outcomes. Hence, the reasons for lower levels of therapist-related stress after a therapy program can be explained by the strong and trusting relationships among group members and with the therapist throughout the therapy sessions. Trust also helps reduce the chances of negative mood during therapy and early termination of therapy.

In the current study, regimen-related distress as a subscale of diabetes distress also showed a dramatic change after therapy among participants of the experimental group in comparison to the control group. Evidence indicated that group CBT helped lower diabetes distress as a result of self-monitoring behavior, taking care of diet, and improved health behaviors. Daily recording of food and blood sugar enabled patients to identify problematic points in their meal patterns and make a better plan for next day. They could clearly see the connection between their dietary plan and its impact on blood sugar level, and take responsibility for it. Thus participants could reduce their regimen-related distress and were motivated to continue to manage their diabetes.

Interpersonal distress, as another subscale of diabetes distress, asked whether or not the patient received his/her desired emotional support from family and friends. The mean scores of interpersonal diabetes distress for participants in the experimental group reduced after therapy, supporting the research about diabetes management on the beneficial effects of social support.

In all therapy sessions in the present study, participants shared their experiences and emotions, and clearly benefited from sharing, learning, and showing empathy in a group setting. Although most of the participants of the study were employees of Universiti Sains Malaysia, for many of them, it was their first time to share their experiences regarding diabetes. As a result, many new relationships were built among the participants even beyond the therapy sessions, which is a good indication that such support will continue into the future. This achievement can be explained by the interpersonal principles of psychotherapy. Yalom and Leszcz (2005) supported a group setting for therapy, because it gives participants the opportunity to become aware of their difficulties and to build sustainable relationships. Participants in groups also have the chance to observe one another's behavior and modify previously learned dysfunctional interpersonal behavior.

The results of the present study revealed that group CBT produces a reduction in diabetes distress level and improvement in blood sugar level. Given the potential importance
of such findings, it is suggested a larger-scale study be conducted, incorporating further methodological refinements such as expanding the locations of the sample collection to have a larger sample with diverse ethnic groups and inclusive of all age groups and a lengthy follow-up assessment.

1 This term used to describe a person who is helping people with diabetes during their treatment such as a medical doctor, a psychologist or a nurse.

Acknowledgements

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The present research approved by Medical Research and Ethics Committee of the Ministry Health Malaysia, and informed consent was obtained from all patients participated in the study.

References


Corresponding Author
Seyed Reza Alvani
School of Social Sciences.
Universiti Sains Malaysia (USM),
Penang Island, Malaysia
Tel: 0060125998071

Email: sralvani79@yahoo.com