Effect of stress management training on glycemic control in patients with type 1 diabetes

Abbas Attari [a,*], Mahnaz Sartippour [b], Massoud Amini [b,c], Sassan Haghighi [b]

[a] *Department of Psychiatry, Faculty of Medicine, Isfahan University of Medical Sciences and Health Services, Isfahan, Iran*
[b] *Endocrine & Metabolism Research Center, Isfahan University of Medical Sciences and Health Services, Isfahan, Iran*
[c] *Department of Internal Medicine, Faculty of Medicine, Isfahan University of Medical Sciences and Health Services, Isfahan, Iran*

Abstract

Aims: In this study, the effect of stress management training on glycemic control has been investigated in type 1 diabetic patients.
Methods: The participants were 60 type 1 diabetic patients (aged 16–30). 30 Subjects attended in 3-month stress management training classes during which the prescribed insulin remained constant, but the remainder 30 ones did not. HbA1 from all patients were measured before and after the intervention. Besides, in order to assess the ways of coping, every patient completed a questionnaire and the scores were compared between two groups.
Results: Trained patients showed significantly improved ways of coping. HbA1 changed from 11.7 ± 2.9 and 10.9 ± 2.1 before training to 8.5 ± 1.7 and 10.3 ± 2.1 after intervention in trained and control groups respectively and the changes were significant in study group ($P < 0.001$). In addition, the difference between means of HbA1 of two groups was statistically significant at the end of the study ($P < 0.001$).
Conclusions: Results show a clinically significant beneficial effect of stress management training on glycemic control among type 1 diabetic patient. It is recommended to consider this type of training as an addition to the treatment program in type 1 diabetic patient.
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Keywords: Type 1 diabetes; Stress management; HbA1

1. Introduction

Diabetes is a chronic disease in which appropriate management plays a major role in limitation of its complications. On the other hand, control of type 1 diabetes, because of its special manner that needs frequent insulin injections, FBG control, life style modification and diet changes, can itself be a stressful event for the patients. Scientific evidences have showed the role of stress in FBG increase mediated by neuroendocrine system activity [1] and influences on food habits, physical activity and other related self-care behaviors [2,3] that finally result in glycemic imbalance. It seems that appropriate training of patients about stress management can be actually effective on glycemic control. Some previous studies have showed the effectiveness of stress management methods in glycemic control of type 1 diabetes [4,5], while others reported no beneficial effects [6].

* Corresponding author at: Behavioural Sciences Research Centre, Khorshid Hospital, Ostandari St., PO Box 81465-993, Isfahan, Iran. Tel.: +98 311 2222135; fax: +98 311 2222135.
E-mail address: bsrc@mui.ac.ir (A. Attari).

In this study, it has been tried to investigate the effect of stress management training on glycemic control in type 1 diabetic patient.

2. Patients and methods

This study was conducted on 60 type 1 diabetic patients referred to Isfahan Endocrine and Metabolism Research Center. Those patients who had a history of regular referring to the center for at least one year and aged 16–30 years (as the method of stress management is not appropriate for patients aged < 16 years and prevalence of diabetes type 1 is low over 30 years of age) were included. Qualified subjects were divided in study (30 subjects) and control (30 subjects) groups and matched for sex and age. Subjects who gave up stress management training, had medication dose changes, had a history of severe diabetes complications or were on psychoac-

tive drugs were excluded from research. All participants gave written informed consent to the trial, which was conducted in accordance with the Declaration of Helsinki and the approval of the ethics committee of the Isfahan University of Medical Sciences.

After sampling, the patients in study group attended training classes on stress management for three months while controls did not. Each class lasted for 2 h with 10–15 participants so that each participant took part in eight sessions. The classes were held using discussion method and mutual talk under supervision of an experienced psychiatrist. The participants were asked to perform homework for each session and report the results in the next session. The content of each class has been described in Table 1.

SM questionnaire was used to collect data about ways of coping [7]. In this 26-item questionnaire, each item shows one method of coping with stress (17 positive and 9 negative items). There are two columns for each item, the first for the

Table 1
The curriculum of classes of stress management

Session	Duration (h)	Content	Task
1st week	2	The nature of stress. The physiological and psychological response to any demand Some degree of stress is essential for life The nature of stressors	Some question about stress and stressor
2nd week	2	Personality factors Environmental factors	To determine the environmental stresses
3rd week	2	The effects of stress Stress may lead directly and indirectly to illness The type of illness from stress The type A personality	To list the individual stresses
4th week	2	Stress-related aspects of diet Diet management Lifestyle changes	Report the change of their diet during next week
5th week	2	Improving one's skills Establishing routines Personality changes Intentionally changing the stressful aspects of one's personality	Listing tasks in order of their importance
6th week	2	Improving one's self-concept Becoming more assertive Improve one's self-concept Thought-stopping Developing close friendships Type A behavior can be reduced	If they will success to reduce stress by personality change during next weeks
7th week	2	Muscle relaxation training	Try to do MRT 2–3 time every day for at least 20 min for each session
8th week	2	Physical activity using physical activity as a stress management technique Swimming running, dancing, biking, and other individual sports are appropriate A regular physical activity program	Report their program for daily physical activity

Table 2
The profile of patients and control group[a]

Parameters	Patients, mean (S.D.)	Control group [range]	P-value
Age (year)	19.7 (3.29) [16–30]	20.8 (9.52) [16–30]	0.5
Duration of diabetes (year)	2.1 (0.6) [1–5]	2.14 (2.3) [1–5]	0.9
Duration of therapy (year)	2.1 (0.6) [1–5]	2.12 (2.2) [1–5]	0.9
Daily of insulin (Unit)	85 (60) [30–200]	73(39) [30–200]	0.06

There was no late complications of diabetes due to short duration of disease.

[a] Patients were on insulin injections 2 or 3 times daily, half an hour before breakfast, dinner (±lunch).

frequency of item use (often, sometimes, never) and the second one indicating the effectiveness of stress management (a lot, a little, no). The questionnaires were filled in item by item for each participant in both groups and HbA1 levels were measured simultaneously before the study. After completion of questionnaires, total and subtotal scores were calculated using following equations

total score (TS)

$$= \frac{\text{sum of 'SOMETIMES' + 'OFTEN' answers}}{\text{total number of participants}}$$

subtotal score (SS)

$$= \times 100 \frac{\text{number of 'OFTEN' answers}}{\text{sum of 'SOMETIMES' + 'OFTEN' answers}}$$

The participant's perceptions regarding the effectiveness of positive techniques to cope with stress was scored as:

$$\text{percent of patients felt stress} - \text{reducing effect of positive coping methods}$$
$$= \frac{\text{sum of positive items with 'A LOT' and 'A LITTLE' answers}}{\text{sum of positive items with 'OFTEN' and 'SOMETIMES' answers}} \times 100$$

The means of scores and HbA1 for each group were compared before and after the intervention by paired t-test and between two groups by *t*-student statistical method. SPSS Ver. 10 was used to analyze the data and $P < 0.05$ was considered significant.

3. Results

The profile of patients has been shown in Table 2. There were total of 60 subjects taking part in this study (41.7% male, 58.3% female). The mean of age was 19.7 ± 3.29 and 20.8 ± 4.52 in study and control groups, respectively. Tables 3 and 4 show the mean of scores of positive and negative items often used to cope with stress as well as their total (TS) and subtotal scores (SS) in both study and control groups Tables 5 and 6. Despite significant decrease in TS of negative items application in control group, there was a significant increase in the mean of changes observed in mentioned score between two groups ($P < 0.001$). In addition, the mean of TS for both negative and positive items showed no significant difference between study and control groups at the beginning of the study, while it was significant with $P < 0.001$ and $P = 0.005$ for negative and positive items respectively after the intervention. Baseline SS of positive and negative items did not differ between two groups the beginning of the study but the difference was significant for negative ($P < 0.001$) and positive ($P = 0.047$) items at the end of the study. In control group, percent of patients who reported a beneficial effect of positive coping methods used for stress management changed from 45.96 ± 14.7 to 44.39 ± 12.7 ($P = 0.66$), that was in spite of patients of study group in whom this percent improved from 38.59 ± 10.9 to 64.2 ± 7.6 ($P < 0.001$). Although the

Table 3
Mean ± S.D. of scores related to negative items applied 'OFTEN' in type 1 diabetic patients and control groups, before and after training

	Before training	After training	P-value
Study group	1.42 ± 1.8	0.64 ± 0.73	0.001
Control group	1.81 ± 2.43	1.34 ± 2.9	0.085
P	0.1	0.001	

Table 4
Mean ± S.D. of scores related to positive items applied 'OFTEN'

	Before training	After training	P-value
Study group	5.06 ± 2.75	8.13 ± 2.44	0.001
Control group	5.63 ± 2.97	5.8 ± 2.09	0.725
P	0.4	0.001	

Table 5
Total scores (TS) related to positive and negative items

		Positive items	Negative items
Study group	Before training	3.73 ± 12.66	1.82 ± 4.03
	After training	3.01 ± 13.7	0.92 ± 1.9
	P-value	0.158	0.001
Control group	Before training	3.25 ± 11.93	1.65 ± 4.43
	After training	2.89 ± 11.46	1.78 ± 3.93
	P-value	0.462	0.045

Table 6
Subtotal scores (SS) related to positive and negative items

		Positive items	Negative items
Study group	Before training	39.06 ± 16.6	43.1 ± 26.9
	After training	61.62 ± 23.5	39.2 ± 34
	P-value	0.001	0.634
Control group	Before training	46.58 ± 20.53	57.19 ± 34.65
	After training	50.89 ± 16.71	71.68 ± 28.65
	P-value	0.35	0.062

Table 7
Means of blood pressure (mmHg) and pulse rate before and after stress management training

		Study group	Control group	*t*	*P*-value
Before SMT	BP Min	69.9 ± 11.6	67.8 ± 12.0	0.68	0.49
	Max	108.9 ± 20.6	111.0 ± 21.2	0.38	0.7
	PR	86 ± 12.31	91 ± 13.12	1.52	0.13
After SMT	BP Min	67.1 ± 11.5	68.0 ± 13.1	0.28	0.78
	BP Max	99.1 ± 19.8	111.2 ± 21.2	2.28	0.026[*]
	PR	81 ± 12.11	92 ± 13.70	3.30	0.0016[*]

[*] Significant difference.

percent mentioned above showed a significant difference between study and control groups before education ($P = 0.03$) but the significance changed to $P < 0.001$ at the end of the study. HbA1 levels decreased in study and control groups from $11.7 ± 2.9$ to $8.5 ± 1.7$ ($P < 0.001$) and $10.9 ± 2.1$ to $10.3 ± 2.1$ ($P = $ NS), respectively. Besides, the non-significant difference of HbA1 observed between two groups before educational sessions changed to a significant one ($P < 0.001$) after the intervention. Mean of HbA1 in the study and control group were $8.5 ± 1.7$ and $10.3 ± 2.1$, respectively, at the end of 3-months class, and it was significantly higher in control group. The mean of blood pressure and mean pulse rate before and after stress management training was shown in Table 7. Street management training significantly has decreased blood pressure (max.) and pulse rate.

4. Discussion

Nowadays, stress is more considered as a pathogenic factor to cause or deteriorate numerous health disorders. Wrigley and colleagues [8] studied 89 type 1 diabetic patients with inappropriate control and showed that social stress could result in poor glycemic control. Lloya CE and colleagues [9] also reported that recent acute stressors are associated with inappropriate control in type 1 diabetic patients. These investigations and other similar studies [4,10,14] prove the importance of stress management in order to get good glycemic control in patients with type 1 diabetes.

Findings of this study show that well-designed training programs concerning the techniques of stress management can affect the way of coping with stress in

type 1 diabetic patients so that at the end of the research, patients in study group applied negative coping methods with a significantly decreased frequency and there was a significant difference between the case and control groups regarding this matter. Besides, these educational courses actuated the patients in study group to apply positive methods of coping more frequently when compared with the control group as well as the beginning of the study. Despite significant increase in TS of negative items in control group, there was a significant difference in the mean of changes observed in mentioned score between two groups ($P < 0.001$), proving the positive effects of stress management training on the ways of coping with stress among this group of patients.

Comparison of HbA1 levels in both groups before and after the intervention revealed a significant decrease in study group. Besides, HbA1 levels, which did not differ significantly between two groups before the training, showed a significant change after the intervention. Since patients were using a fixed dose of insulin during the research, HbA1 changes should be principally due to the stress management training in study group. In fact, it seems that improvement observed in the ways of coping in trained patients, who resulted in a better management of stress, has been associated with appropriate glycemic control in these patients.

Findings of our study are in agreement with the results of some other investigations. Rosenbaum [15] studied four type 1 diabetic patients who had started a biofeedback-assisted stress management program for reasons other than diabetes and observed a decrease in insulin requirements in some of them. In the study of McGrady and his colleagues [16], significantly lower average blood glucose levels were observed in 18 adults with type 1 diabetic patients after biofeedback-assisted relaxation training, which could not be explained by increase in insulin. In another study performed by this researcher [17], stress management using biofeedback-assisted relaxation training decreased the average of blood glucose values in a female patient with unstable type 1 diabetes and the improvements were maintained at 1 year follow-up with constant or slightly decreased insulin dosage. Spiess et al. [18] investigated the relationship between psychosocial adjustment and subsequent glycemic control in recent onset type 1 diabetic patients. They observed that some specific coping features like high control attitude and low coping anxiety were correlated with the decrease in HbA1c levels so that coping was responsible for 22% variance of the 2-year

decrease in HbA1c levels. In contrast to these findings, Feinglos MN [6], in his study on type 1 diabetic patients, showed that 1 week of in-hospital biofeedback-assisted progressive muscle relaxation did not improve glucose tolerance and after 6 weeks of continuing these techniques at home, no decrease was observed in HbA1c or insulin dose among patients. However, this researcher suggested further investigations to be performed on subpopulations of type 1 diabetic patient who have demonstrated stress-induced hyperglycemia.

In conclusion, our results show that stress-management training can play a considerable role in improvement of glycemic control among type 1 diabetic patients. These training programs should be considered more as an important component of comprehensive treatment programs for type 1 diabetic patient.

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