MINDFULNESS-BASED STRESS REDUCTION IS ASSOCIATED WITH IMPROVED GLYCEMIC CONTROL IN TYPE 2 DIABETES MELLITUS: A PILOT STUDY

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Context • Psychological distress is linked with impaired glycemic control among diabetics.
Objective • Estimate changes in glycemic control, weight, blood pressure, and stress-related psychological symptoms in patients with type 2 diabetes participating in a standard Mindfulness Based Stress Reduction (MBSR) program.
Design • Prospective, observational study.
Setting • Academic health center.
Patients • Adult patients with type 2 diabetes mellitus.
Interventions • Participation in MBSR program for heterogeneous patient population. Diet and exercise regimens held constant.
Main Outcome Measures • Glycosylated hemoglobin A1c (HA1c), blood pressure, body weight, and Symptom Checklist 90-Revised (anxiety, depression, somatization, and general psychological distress scores).
Results • Eleven of 14 patients completed the intervention. At 1 month follow-up, HA1c was reduced by 0.48% (P=.03), and mean arterial pressure was reduced by 6 mmHg (P=.009). Body weight did not change. A decrease in measures of depression, anxiety, and general psychological distress was observed. (*Altern Ther Health Med*. 2007;13(5):36-38.)

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Psychological distress is linked with impaired glycemic control in diabetics and increased risk of diabetes mellitus.[1-6] Physiological responses to stress, including increased glucose production, glucose mobilization, and insulin resistance, could partially mediate this risk.[7-9] Although stress-reduction interventions may improve glycemic control among people with diabetes, data are limited and results are conflicting.[5,10-14]

Mindfulness-Based Stress Reduction (MBSR) is an 8-week group intervention shown to reduce stress-related symptoms in various patient populations, but the program is yet untested in diabetic cohorts.[15,16] The core of MBSR involves training in mindfulness meditation, a practice of self-regulating attention that lowers reactivity to stress triggers.[17] Aims of the current pilot study were to estimate changes in glycemic control, weight, blood pressure, and stress-related psychological symptoms in patients with type 2 diabetes participating in a standard MBSR program.

RESEARCH AND DESIGN MODELS

This prospective observational study included adults aged 30 to 75 years treated with oral hypoglycemic agents but not with insulin. Additional inclusion criteria were glycosylated hemoglobin (HA1c) >6.5% and <8.5%; fasting blood glucose <275 mg/dL upon screening and again at baseline; no change in medication, diet, or exercise <12 weeks prior to intervention; absence of severe psychopathology (eg, psychotic disorder or substance use disorder); and no current meditation practice. To avoid confounding effects of changes in medication, diet, or exercise, participants were excluded from analyses if they reported such changes during the intervention.

Subjects participated in a standard MBSR intervention for heterogeneous patient populations at an academic health center.

TABLE Treatment-related Changes in Glycemic Control, Weight, and Blood Pressure*

	Baseline (Week 0)	Post-intervention (Week 8)			Follow-up (Week 12)		
Outcome variable			*P*	*d*§		*P*	*d*§
Glycemic control (HA1c %)	7.50 ± 0.51	7.23 ± 0.67	.14	.46	7.02† ± 0.58	.03	.88
Weight (lbs)	236 ± 48	238 ± 50	.20	.04	240 ± 46	.10	.09
Mean arterial pressure (mmHg)	100 ± 12	97‡ ± 10	.07	.27	94† ± 13	.009	.48

*Data are reported as mean ± SD. †$P<.05$ for paired, 2-tailed *t*-test with pre-intervention mean. ‡$P<.10$ for paired, 2-tailed *t*-test with pre-intervention mean.
§Interpretative ranges: 0.20=small, 0.50=medium, 0.80=large.[19]

MBSR consists of 8 weekly 150-minute sessions plus a 7-hour weekend session. The program follows the curriculum developed at the University of Massachusetts Stress Reduction Program by Dr Jon Kabat-Zinn.[17] A range of mindfulness meditation techniques are taught: body scan, awareness of breathing, mindful walking, mindful eating, and mindful communication. In all of these practices, the participant trains to pay full attention to present-moment experience, choosing to respond skillfully rather than react automatically to external events, thoughts, emotions, or sensations as they arise. Each participant receives 2 practice compact discs to support a home practice requirement of at least 20 to 30 minutes of formal meditation per day, 6 days per week.

Outcome measures were taken at 3 time points: baseline (week preceding MBSR), program completion (week 8), and 1-month follow-up (week 12). Variables included HA1c, a measure of average blood sugar over the prior 12 weeks; blood pressure; weight; and selected subscales from the Symptom Checklist 90-Revised (depression, anxiety, somatization, general severity index[18]). Data on compliance with home meditation practice were collected weekly during the intervention. Paired *t*-tests (2-tailed, α=.05) were used to compare baseline, post-intervention, and follow-up means on dependent variables. Cohen's *d* was used to estimate the magnitude of treatment effect sizes at post-intervention and follow-up relative to baseline status.[19] Data are reported as mean ± SD unless otherwise indicated.

RESULTS

Fourteen patients enrolled (5 men, 9 women). Mean age was 59.2 ± 2.57 years. Ten subjects were Caucasian; 4 were African American. Average time since diagnosis was 7.36 ± 1.63 years. Eleven subjects completed the intervention: 1 subject dropped out of the MBSR program, 1 subject was excluded because medication was decreased during the study period, and 1 subject was excluded because medication was increased during the study period. Compliance with home meditation practice was excellent, with subjects reporting a mean of 6.5 (±0.9) sessions per week for 24 (±2.5) minutes per session. No changes in diet or exercise regimen were reported during the investigation.

As shown in the Table, a downward trend in HA1c was observed after 8 weeks at completion of intervention (*P*=.14, *d*=0.46). A statistically significant reduction in HA1c of 0.48% was found at 1 month follow-up, representing a large magnitude effect size (*P*=.03, *d*=0.88). A downward trend in mean arterial pressure was also seen at 8 weeks (*P*=.07, *d*=0.27), reaching statistical significance at 1 month follow-up (*P*=.009, *d*=0.48). There was no change in mean body weight during the study period.

Symptoms of depression, anxiety, and general psychological distress decreased by 43%, 37%, and 35%, respectively, upon completion of the intervention (depression: *P*=.03, *d*=0.86; anxiety: *P*=.33, *d*=0.43; general severity index: *P*=.07, *d*=0.60). No change in somatization was detected. Follow-up means at 12 weeks were not significantly different compared to post-intervention means.

DISCUSSION

Results of this pilot study support the hypothesis that MBSR training is associated with improved glycemic regulation in type 2 diabetes. Changes in lifestyle do not account for the observed reduction in HA1c. There were no reported changes in medication, diet, or exercise that could account for improved glycemic control. Mean body weight did not change, making unreported significant changes in diet or exercise unlikely.

An alternative explanation recognizes the counter-regulatory effects of the physiological response to stress. Stress-mediated production of cortisol, norepinephrine, beta endorphin, glucagon, and growth hormone increases blood glucose and insulin resistance. Mindfulness training appears to interrupt or down-regulate an individual's psychological reactivity to stress triggers, which may in turn mitigate physiological stress response and thereby improve glycemic regulation. In this pilot, reduction in mean arterial pressure may be another physiological marker of stress response modulation.

Trends in psychological symptom reduction further support a stress-reduction hypothesis. Psychometric data were generally consistent with those reported for heterogeneous subjects participating in MBSR[20]; statistical significance may not have been reached due to the small sample size.

Limitations of the present study include absence of a control group and a small cohort size. These promising findings warrant further investigation of MBSR with a randomized clinical trial.

Acknowledgment

This research was supported by the Diabetes Action Research and Education Foundation, Washington, DC.

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