

In Brief

Mind-body interventions utilize the mind's capacity to affect the body and its physiological responses. They thereby influence health. The response to stress (the "fight or flight" reaction) may be automatic, but recovery toward relaxed parameters ("the relaxation response") can be learned through self-regulation and the regular use of mind-body interventions. Many of these interventions originate from Eastern healing practices. Western science has found some of them to be helpful as adjunct modalities in the treatment of disease, and their use is increasing.

Mind-Body Interventions

Birgitta I. Rice, MS, RPh, CHES

Mind-body medicine focuses on the communication between mind and body and the powerful ways in which emotional, mental, social, and spiritual factors can directly affect health. Western, or allopathic, medicine tends to consider the scientific, or medical, model of medicine superior to mind-body therapies. It often has negated the fact that one's mind has any affect on the body. But in the last generation, with the meeting of Eastern and Western healing practices, we have come to accept and understand that mind and body are powerfully related.

Between 1990 and 1997, the number of patients using alternative practices increased from 36 to 46%.¹ Quality clinical research has grown steadily since 1970. The National Center for Complementary and Alternative Medicine (NCCAM), founded in 1998 as part of the National Institutes of Health, is now a vital organization for disseminating information and providing funding options for complementary or alternative medical research.

Mind-body interventions include relaxation, imagery, biofeedback, meditation, hypnosis, tai chi, yoga, and others. They often help patients experience healing for their illnesses in new and different ways.

A mind-body modality we often experience, many times unbeknownst to us, is the placebo response. It hap-

pens even without our planning or effort. In scientific studies, it has been shown to interfere with clinical outcomes. It is often looked upon as puzzling or confusing and unfortunately has thereby been undervalued.² A positive placebo response typically improves a patient's trust and hope for an affirmative outcome.

Mind-body therapies regard as essential an approach that acknowledges each person's capacity for self-knowledge and self-care. It emphasizes the person's openness to participate and his or her desire to succeed. It often has been said that mind-body medicine views illness not as an obstacle but as an opportunity for personal growth and transformation.

Further training of medical health professionals is needed to improve understanding of the benefits of the mind-body therapies. Likewise, practitioners of spirituality and mind-body interventions need to be more appreciative of the successes that the scientific practice of medicine has made available. Together, they can help augment clinical outcomes whenever possible.

Dean Ornish, MD, a cardiologist and founder of the Preventive Medicine Research Institute in Sausalito, Calif., has done just that. He showed that comprehensive lifestyle changes (low-fat vegetarian diet, smoking cessation, stress-man-

agement training, and moderate exercise) for patients with heart disease can actually reverse coronary heart disease.³

Table 1 lists many of the mind-body therapies and offers a brief description of their potential physiological benefits.

How do these therapies work? What is the trigger? In many, if not all, methodologies, the basic dynamic feature is the “relaxation response.” Herbert Benson, MD, of the Mind-Body Medical Institute at Harvard University⁴ coined the phrase “relaxation response” after carrying out research on the effects of meditation in collaboration with national and international scholars. The relaxation response is a state in which the body slows down and heart rate, blood pressure, and breathing slow down,

facilitating the uptake of oxygen. The body achieves a sleep-like rest (an altered state of consciousness) in a brief period of time.

Conversely, the stress response, or the “fight or flight” response, includes increased levels of heart rate, breathing, blood pressure, blood glucose, and stress hormones. Excess stress-induced levels of adrenaline or cortisol may damage the blood vessels and also compromise the immune system.^{5,6}

Keeping excess stress hormones in check with relaxation may help stabilize glucose levels and at the same time provide some protection for the heart.³ These are both very important issues for people with diabetes.

Mind-body therapies work for some people, but they may not work for everyone. Remember, we are deal-

ing with two interdependent variables here, mind and body, which then have to interact with all the other bodily functions.

It is not easy to design research methodologies that produce significant outcomes in such challenging situations. Grant opportunities have been few compared to those available for drug research, reflecting the limited profit potential of complementary and alternative medicine research. The remainder of this article describes some of the therapies that have been researched and published in peer-reviewed journals. As expected, there are a variety of studies both with and without positive results regarding their effect on diabetes.

Relaxation and Biofeedback-Assisted Relaxation Techniques

Feelings of stress raise blood glucose levels in people with diabetes. This is because of an increased production of stress hormones,⁷ which reduces insulin action. In addition, patients under perceived stress may find that caring for their diabetes is less of a priority, leading to poor glycemic control, which further exacerbates the situation.

It is therefore important for diabetes health professionals to be aware of and to check with their patients about how stress may be affecting their lives. Health care professionals can then offer advice specific to their patients’ situation. Perhaps some additional lifestyle changes could be recommended for stress reduction. As noted earlier, decreasing stress reactions may lead to better glucose control and improvement in immune system function.

Glucose management. With increased glycemic control, there is always a risk for hypoglycemia. When in a relaxed state, the body metabolizes carbohydrate more efficiently, thereby lowering blood glucose levels.^{8,9} Patients with type 1 diabetes may potentially develop hypoglycemia following relaxation.^{9,10} Therefore, such patients should be told of the possibility for low blood glucose levels after relaxation and instructed to promptly treat it as directed by their health care professional.

In published, peer-reviewed research studies featuring diabetes and blood glucose, the most common alternative treatment is relaxation training or biofeedback-assisted relaxation training. Many case and con-

Table 1. Overview of Mind-Body Interventions

Modality	Description and potential physiological benefits
Relaxation	A state of altered consciousness, a slowing of breath and heart rate.
Meditation	A process of training one’s mind to be attentive, to focus in a nonanalytical way, an attempt to refrain from rumination, ⁴ as in relaxation.
Hypnosis	The induction of trance states by therapeutic suggestion, a state of altered consciousness. Facilitates behavior and lifestyle changes, overcoming addictions.
Imagery	The formation of images in perception, thought, feeling, memory, and fantasy, all in the absence of sensory stimulants (seeing, hearing, feeling, smelling, tasting). May improve immune function, speed surgical recovery.
Visualization	Active imagery to influence attitude, behavior, or physiological responses. Even faint intentional imagery of thought activates the brain to release neurotransmitters to the corresponding neural and hormonal pathways.
Autogenic Training	Relaxation and self-hypnosis using a specific, tested sequence of wording.
Aromatherapy	Stimulation of the sense of smell to encourage relaxation, well-being, or other physiological benefits.
Biofeedback	Adjustment of thinking processes and regulation of physiological functions with feedback from monitoring instruments. Helps to control blood pressure, muscle tension, heart rate, brain waves, and skin temperature.
Psychotherapy	Treatments ranging from simple listening to combinations of medication, counseling, and discussion, using behavioral/emotive approaches.
Support Groups	Group interventions that promote bonding and belonging, being understood, self-expression, learning, stress relief, and longevity. Decreases anxiety and isolation. ³⁵
Dance and Exercise	Movement to improve self-esteem, facilitate attention, express anger, and develop a more positive body image.
Yoga	A system of developing discipline to achieve body postures, control breathing, and reduce stress and stress hormones, thereby boosting the immune system.
Music and Art	Pursuits that help in developmental disabilities and are effective as an analgesic or relaxant.

trolled studies using biofeedback-assisted relaxation training with type 1 diabetic patients showed significantly lower average blood glucose levels in experimental groups or at post-test in the instance of case studies.¹¹⁻¹³ These differences could not be explained by increased insulin doses.¹¹ It is suggested that stress management be considered as an adjunct to the medical management of people with type 1 diabetes.

In studies of patients with type 2 diabetes, no significant lowering of glycemic levels were observed at post-test.^{14,15} However, with relaxation training, patients may have experienced other benefits, such as increased self-management abilities, improved sense of well-being, increased coping skills, lowered incidence of depression, and less perceived stress. Some studies have not been designed to provide statistically significant results for more than one or two variables.

Depression. Depression is a frequent comorbidity of chronic illness and diabetes.¹⁶ People with diabetes who suffer from depression or anxiety struggle more to control their blood glucose levels, even if they are taught biofeedback and relaxation techniques. A small, controlled study followed 18 insulin-dependent diabetic patients with depression.¹⁷ Four weeks after the treatment ended, researchers found little difference in the daily blood glucose measurements between patients who were taught to practice relaxation at home and those who were not. Depressed patients often have difficulty executing the self-care activities associated with diabetes. The additional demands of a relaxation treatment plan may have been similarly difficult to follow.

Blood circulation and healing. The autonomic nervous system is composed of the sympathetic branch (active in response to stress), and the parasympathetic branch (active during relaxation and digestion). Relaxation, or self-regulation of the sympathetic nervous system activity, can be accomplished in various ways including hand- and foot-warming. In a general way, this may be thought of as quieting the emotions.

When relaxing, the sympathetic nervous system tone is lessened. Muscles relax—not only the large ones, but also the musculature surrounding the capillary blood vessels. This relaxation allows a reduction in blood pressure and improved perfu-

sion to the peripheral blood vessels, thereby increasing blood flow to the extremities.¹⁸ With the improved blood flow comes increased oxygenation and nutrition of the tissues.

In the studies of Rice et al.,^{19,20} this hypothesis was proven valid. A within-subjects design study of 40 people with diabetes¹⁹ demonstrated that subjects responded positively to thermal biofeedback-assisted relaxation by increasing peripheral vasodilation. This increased blood flow by an average change score of 22.5% (blood volume pulse [BVP] measured with photoplethysmography). Change scores were expressed as a percentage of the optimal BVP change (100%) as follows for each participant: [(post-BVP score – pre-BVP score)/(100 – pre-BVP score)] × 100. Similarly, for the temperature change score, the optimal value used was 98.6° Fahrenheit. The average increased toe temperature change score was 31.4%, ($P < 0.001$).

A multi-center, controlled clinical trial of patients with chronic non-healing foot ulcers²⁰ produced significant results in healing. Of participants in the experimental group who were taught thermal biofeedback-assisted relaxation (increased blood flow to the feet), 14 out of the 16 ulcers, or 87.5%, healed. In the control group, 7 out of 16 ulcers, or 43.75%, healed ($P < 0.009$).

Neuropathy pain. Diabetic peripheral neuropathy affects the sensory nerves in the feet with pain and, later, with loss of feeling. The additional oxygenation and available nutrients to the tissues following the effects of relaxation provide improved sensory function in the nerve fibers that correspond to touch.²⁰ This was shown by measuring the Current Perception Threshold (CPT) levels by electrical stimulation of the great toe. The change in CPT levels pre- to post-intervention indicated a significant difference between the experimental and control groups. A significant improvement (increased sensation in the feet) was noted in the large myelinated nerve fiber functioning in the experimental groups, which used biofeedback-assisted relaxation, compared to the control groups who did not ($P < 0.02$).

In another study by Fiero et al.,²¹ it was suggested that diabetic neuropathy might interfere with the ability to self-regulate peripheral temperature and that assessing neuropathic status may be important before prescribing

thermal biofeedback. On the other hand, in mind-body therapies, “thinking of warmth” may surpass or be more accurate than “feeling warmth.”

The beneficial effects of thermal biofeedback-assisted relaxation have been demonstrated for several additional vascular disorders, including hypertension,²² migraine,²³ and Raynaud’s syndrome.²⁴

Claudication. This is a disease process involving inadequate peripheral blood flow. Thermal biofeedback has been tested as a therapy to improve vascular flow and walking tolerance in patients with peripheral vascular disease.²⁵ Improvements were seen in ankle-brachial index, walking distance, walking speed, and stair climbing. Thermal biofeedback provided an improved vascular and ambulatory function for a diabetic patient with claudication.²⁵

Another case study of a patient with diabetes reported that attacks of intermittent claudication were reduced to zero after 12 sessions of thermal biofeedback. The patient’s daily walking distance increased by about a mile over the course of the treatment.²⁶ Thus, it appears that thermal biofeedback and autogenic training are potentially promising therapies for people with diabetes and peripheral vascular disease.

Hypnosis

This modality has been used to help people with eating disorders and those in need of assistance with smoking cessation and other lifestyle changes.²⁷ Adolescents with type 1 diabetes have been reported to have a nonadherence rate of ~20% to diet, exercise, and other self-care behaviors.²⁸ In a hypnosis study,²⁸ six adolescents served as their own controls, and no changes were made in insulin, diet, or exercise for 6 months. Then hypnosis, administered individually, was added with all of the usual modalities for 6 months. Posttreatment tests showed that average HbA_{1c} dropped from 13.2 to 9.7%, and average fasting blood glucose (FBG) dropped from 426 to 149 mg/dl.

Yoga

In yoga, people with diabetes may have found an important “new” tool that is thousands of years old. Research has shown Hatha yoga (physical movements and postures) and meditation to be excellent examples of the mind-body connection at

work. Yoga may provide real benefits in stabilizing blood glucose.²⁹ If done properly, yoga also counts as an aerobic exercise.

Jain and associates³⁰ studied the response patterns of people with type 2 diabetes to yoga therapy. Their study showed 70% of participants to have a fair to good response to yoga therapy. After 40 days of yoga, there was a significant reduction in hyperglycemia measured by FBG and oral glucose tolerance test. It has been suggested that yoga, a simple and economical therapy, might be considered a beneficial adjunctive and self-administered therapy to medical treatment.

Regular practice is the most important variable with all these mind-body therapies. They are all inherently noninvasive, inexpensive, and safe. Furthermore, many studies have noted that patients using them experience secondary benefits, such as an increased ability to cope with daily stressors, adherence to prescribed treatments, increased ambulation, and positive outlook on life.^{13,31-34}

Strategies for Including Mind-Body Therapies

Educational interventions are different from drug therapy and other medical interventions in that patients must accept a much greater personal responsibility for the conduct and success of these treatments. Most of the mind-body therapies involve patient education, supervised practice, and regular practice at home.

Both educator and patient are the beneficiaries of the lifestyle changes and positive attitudes resulting from the mind-body interventions. In addition to providing the education and teaching the techniques, the therapist/educators serve as mentors and human connections to the modality, providing hope and encouragement for patients. Instruction and supervised practice of mind-body skills can be conducted individually or in group settings, which can provide the strength of community.³⁵

Diabetes educators and other health care professionals have been at the forefront of including proven mind-body therapies in their practices. Continuing education courses and certifications in mind-body interventions are available for health care professionals who want to become familiar with mind-body skills and learn how to instruct patients in these therapies. Table 2 offers a list of resources for reference and training.

Practitioners and providers who want to incorporate mind-body interventions may need to educate their hospital and clinic administrators about these therapies. They need to see and be convinced by positive results when mind-body therapies are used in clinical applications. These therapies could be made available to their patients. Mindfulness meditation³⁶ as a form of stress management therapy has made inroads in many health systems.

Table 2. Resources for Reference and Training in Mind-Body Interventions

Center for Mind-Body Medicine

James Gordon, MD, Director
5225 Connecticut Ave., NW, Suite 414
Washington, DC 20015
Phone: 202-966-7338
Fax: 202-966-2589
E-mail: center@cmbm.org
Website: www.cmbm.org

Mind/Body Medical Institute

Herbert Benson, MD
110 Francis St.
Boston, MA 02215
Phone: 617-632-9592
Fax: 617-632-7383
E-mail: mbmi@caregroup.harvard.edu
Website: www.mindbody.com

The Center for Mindfulness in Medicine

Jon Kabat-Zinn, PhD
Professional Training Information
Center for Mindfulness
University of Massachusetts Medical Center
419 Belmont Ave., 2nd floor
Worcester, MA 01604
Website: www.mindfulnessstapes.com

San Francisco Preventive Medicine Institute

Dean Ornish, MD
900 Bridgeway, Suite #1
Sausalito, CA 94965
or
New Medicine Tapes
1308 Gilman St.
Berkeley, CA 94706
Phone: 510-527-3600
E-mail: info@newmed.com
Website:
www.ccnet.com/~newmed/ornish.htm

Life Sciences Institute of Mind-Body Health

2955 SW Wanamaker Dr.
Topeka, KS 66614
Phone: 785-271-8686
Fax: 785-271-8698
E-mail: lifesci@cjnetworks.com

For insurance companies, covering mind-body therapies can be financially beneficial because these therapies are cost-effective, nonpharmacological, noninvasive, and safe. Naparstek³⁷ and Rice et al.²⁰ have shown how relaxation and imagery have increased healing in clinical application. Educated clients become more prevention-oriented and stay healthier.

References

- ¹Eisenberg DM, Davis RB, Ettner SL, Appel S, Wilkey S, Van Rompay M, Kessler RC: Trends in alternative medicine use in the United States, 1990-1997. *JAMA* 280:1569-1575, 1998
- ²Harrington A: *The Placebo Effect: An Interdisciplinary Exploration*. Cambridge, Mass., Harvard University Press, 1999
- ³Ornish D, Brown SE, Scherwitz LV, Billings JH, Armstrong WT, Ports TA, McLanahan SM, Kirkeelde RL, Brand RJ, Gould KL: Can lifestyle changes reverse coronary heart disease? *Lancet* 336:129-133, 1990
- ⁴Benson H: *The Relaxation Response*. Boston, Mass., Morrow, 1975
- ⁵Frichione GL, Stefano GB: The stress response and autoimmunoregulation. *Adv Neuroimmunol* 4:13-27, 1994
- ⁶Kamei T, Toriumi Y, Kimura H, Ohno S, Kumano H, Kimura K: Decrease in serum cortisol during yoga exercise is correlated with alpha wave activation. *Perceptual Motor Skills* 90:1027-1032, 2000
- ⁷McEwen BS: Protective and damaging effects of stress mediation. *N Engl J Med* 329:1246-1253, 1998
- ⁸Curtis JD, Deter RA, Schindler JV, Zirkel J: *Teaching Stress Management & Relaxation Skills: An Instructor's Guide*. La Crosse, Wisc., Coulee Press, 1985
- ⁹Guthrie D, Moeller T, Guthrie R: Biofeedback and its application to the stabilization of diabetes. *Am J Clin Biofeedback* 2:82-87, 1987
- ¹⁰McGrady A, Bailey BK, Good MP: Controlled study of biofeedback-assisted relaxation in type I diabetes. *Diabetes Care* 5:360-365, 1991
- ¹¹Bailey BK, McGrady AV, Good M: Management of a patient with insulin-dependent diabetes mellitus learning biofeedback-assisted relaxation. *Diabetes Educ* 16:201-204, 1990
- ¹²McGrady A, Gerstenmaier L: Effect of biofeedback-assisted relaxation training on blood glucose levels in a type I insulin dependent diabetic: a case report. *J Behav Ther Exper Psychiatr* 21:69-75, 1990
- ¹³Cox DJ, Taylor AG, Holley-Wilcox P, Pohl SL, Guthrie E: The relationship between psychological stress and insulin-dependent diabetic blood-glucose control: preliminary investigations. *Health Psychol* 3:63-75, 1984
- ¹⁴Jablon SL, Naliboff BD, Gilmore SL, Rosenthal MJ: Effects of relaxation training on glucose tolerance and diabetic control in type II diabetes. *Appl Psychophysiol Biofeedback* 22:155-169, 1997

- ¹⁵Lane JD, McCaskill CC, Ross SL, Feinglos MN, Surwit RS: Relaxation training for NIDDM: predicting who may benefit. *Diabetes Care* 16:1087-1094, 1993
- ¹⁶Stein M, Miller AH, Trestman RL: Depression, the immune system, and health and illness. *Arch Gen Psychiatr* 48:171-177, 1991
- ¹⁷McGrady A, Horner J: Role of mood in outcome of biofeedback assisted relaxation therapy in insulin dependent diabetes mellitus. *Appl Psychophysiol Biofeedback* 24:79-88, 1999
- ¹⁸Shulimson AD, Lawrence PF, Iacono CV: The effect of thermal biofeedback-mediated relaxation training on healing. *Biofeedback Self-Regulation* 4:311-319, 1986
- ¹⁹Rice BI, Schindler JV: Effect of thermal biofeedback-assisted relaxation training on blood circulation in the lower extremities of a population with diabetes. *Diabetes Care* 15:853-858, 1992
- ²⁰Rice BI, Kalker AJ, Schindler JV, Dixon RM: Effect of biofeedback-assisted relaxation training on foot ulcer healing. *J Am Podiatr Med Assoc* 91:132-141, 2001
- ²¹Fiero PL, Cox DJ, Fryberg DA, Turkheimer EN, Saunders JT, Phillips II LH: The influence of neuropathy on foot-warming acquisition via thermal biofeedback in diabetic outpatients. *Diabetes Care*. In press
- ²²Fahrion S: Hypertension and biofeedback. *Primary Care* 3:663-682, 1991
- ²³Blanchard EB, Appelbaum KA, Radnitz CL, Morrill B, Michultka D, Kirsch C, Guarneri P, Hillhouse J, Evans DD, Jaccard J: A controlled evaluation of thermal biofeedback and thermal biofeedback combined with cognitive therapy in the treatment of vascular headache. *J Consult Clin Psychol* 58:216-224, 1990
- ²⁴Crockett D, Bilsker D: Bringing the feet in from the cold: thermal biofeedback training of foot warming in Raynaud's syndrome. *Biofeedback Self-Regulation* 4: 431-438, 1984
- ²⁵Aiken JE: Thermal biofeedback for claudication in diabetes: a literature review and case study. *Altern Med Rev* 4:104-110, 1999
- ²⁶Saunders JT, Cox DJ, Teates CD, Pohl SL: Thermal biofeedback in the treatment of intermittent claudication in diabetes: a case study. *Biofeedback Self-Regulation* 19:337-345, 1994
- ²⁷Watters KH: A holistic approach to meeting students' needs: using hypnotherapy techniques to assist students in managing their health. *J School Nurs* 14:44-48, 1998
- ²⁸Ratner H, Gross L, Casas J, Castells S: A hypnotherapeutic approach to the improvement of compliance in adolescent diabetics. *Am J Clin Hypnosis* 32:154-159, 1990
- ²⁹Gimbel MA: Yoga, meditation, and imagery: clinical applications. *Nurse Pract Forum* 9:243-255, 1998
- ³⁰Jain SC, Uppal A, Bhatnagar SO, Talukdar B: A study of response pattern of non-insulin dependent diabetics to yoga therapy. *Diabetes Res Clin Pract* 19:69-74, 1993
- ³¹Aikens JE, Wallander JL, Bell DS, Cole JA: Daily stress variability, learned resourcefulness, regimen adherence and metabolic control in type I diabetes mellitus: evaluation of a path model. *J Consult Clin Psychol* 60:113-118, 1992
- ³²Rosenbaum L: Biofeedback-assisted stress management for insulin-treated diabetes mellitus. *Biofeedback Self-Regulation* 4:519-531, 1983
- ³³Surwit RS, Ross SL, Feinglos MN: Stress, behavior, and the autonomic nervous system in type II diabetes mellitus. In *Neuropsychological and Behavioral Aspects of Diabetes*. Holmes CS, Ed. New York, Springer-Verlag, 1990, p. 184-197
- ³⁴Stein M, Miller AH, Trestman RL: Depression, the immune system, and health and illness. *Arch Gen Psychiatr* 48:171-177, 1991
- ³⁵Spiegel D, Bloom JR, Jalom I: Support for patients with metastatic cancer: a randomized outcome study. *Arch Gen Psychiatr* 38:527-533, 1981
- ³⁶Kabat-Zinn J, Wheeler E, Light T, Skillings A, Scharf MJ, Cropley TG, Hosmer D, Bernhard JD: Influence of a mindfulness meditation-based stress reduction intervention on rates of skin clearing in patients with moderate to severe psoriasis. *Psychosom Med* 60:625-632, 1998
- ³⁷Naparstek B: The value of tapes for surgery (Letter). *Adv Mind-Body Med* 15:157-158, 1999

Birgitta I. Rice, MS, RPh, CHES, is an intervention specialist at The Epidemiology Clinical Research Center, School of Public Health, University of Minnesota in Minneapolis.