

Yoga and Diabetes

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The contents of this bibliography do not provide medical advice and should not be so interpreted. Before beginning any exercise program, see your physician for clearance.

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Abstract: Certain yoga asanas if practiced regularly are known to have beneficial effects on [the] human body. These yoga practices might be interacting with various somato-neuro-endocrine mechanisms to have therapeutic effects. The present study done in twenty four NIDDM patients . . . 30 to 60 year[s] old provides metabolic and clinical evidence of improvement in glycemic control and pulmonary functions. These middle-aged subjects were type II diabetics on antihyperglycemic and dietary regimen. Their baseline fasting and postprandial blood glucose and glycosylated Hb were monitored along with pulmonary function studies. The expert gave these patients training in yoga asanas [and they were practiced] 30-40 min/day for 40 days under guidance. These asanas consisted of 13 well-known postures, done in a sequence. After 40 days of yoga asanas regimen, [tests of] the parameters were repeated. The results indicate that there was significant decrease in fasting blood glucose levels (basal 190.08 +/- 90.8 in mg/dl to 141.5 +/- 79.8 in mg/dl). The postprandial blood glucose levels also decreased (276.54 +/- 101.0 in mg/dl to 201.75 +/- 104.1 in mg/dl), glycosylated hemoglobin showed a decrease (9.03 +/- 1.4% to 7.83 +/- 2.6%). The FEV1, FVC, PEF, MVV increased significantly (1.81 +/- 0.4 lt to 2.08 +/- 0.4 lt, 2.20 +/- 0.6 lt to 2.37 +/- 0.5 lt, 3.30 +/- 1.0 lt/s to 4.43 +/- 1.4 lt/s and 64.59 +/- 25.7 lt min to 76.28 +/- 28.1 lt/min respectively). FEV1/FVC% improved (85 +/- 0.2% to 89 +/- 0.1%). These findings suggest that better glycemic control and pulmonary functions can be obtained in NIDDM cases with yoga asanas and pranayama. The exact mechanism as to how these postures and controlled breathing interact with [the] somato-neuro-endocrine mechanism affecting metabolic and pulmonary functions remains to be worked out.

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the Yoga expert. The Yoga exercises were performed for 30-40 minutes every day for 40 days in the above sequence. The subjects were prescribed certain medicines and diet. The basal blood glucose [and] nerve conduction velocity of the median nerve was measured and repeated after 40 days of [the] Yogic regimen. Another [control] group of 20 Type 2 diabetes subjects of comparable age and severity . . . were kept on prescribed medication and light physical exercises like walking. Their basal & post 40 days parameters were recorded for comparison. Right hand and left hand median nerve conduction velocity increased from 52.81 +/- 1.1 m/sec to 53.87 +/- 1.1 m/sec and 52.46 +/- 1.0 to 54.75 +/- 1.1 m/sec respectively. Control group nerve function parameters deteriorated over the period of study, indicating that diabetes is a slowly progressive disease involving the nerves. Yoga asanas have a beneficial effect on glycemic control and improve nerve function in mild to moderate Type 2 diabetes with sub-clinical neuropathy.

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Abstract: The aim of this study was to evaluate the clinical and metabolic changes observed immediately and 3 months after daily Yoga practices in a group of people with diabetes (DM). The study included sixteen women (3 with Type 1 DM, 12 with Type 2 DM, and 1 with type 2 DM treated with insulin; mean age 61 ± 11 years; DM history 21 ± 14 years) attending the Physical Activity Program at CENEXA – Center of Experimental and Applied Endocrinology (UNLP-CONICET, PAHO/WHO Collaborating Center), National University of La Plata School of Medicine, La Plata, Argentina. Group Yoga practices consisted in âsanas (postures), prânâyâma (breathing exercises), relaxation, and meditation techniques performed twice a week (27 sessions in all), complemented by daily individual sessions practiced at home the remaining days of the week. Data recorded at the beginning and at the end of the study included personal information, clinical and metabolic characteristics, type of treatment and control, and complications. Blood pressure (BP), heart rate (HR), and glycemia also were recorded at the beginning and end of 13 alternate sessions. Both attendance and compliance with the proposed schedule were high (> 80%), excepting 2 people who deserted but completed 50% of the study. There were no overall significant differences (beginning vs. end of the study) in BMI, HbA_{1c}, lipid profile, dietary plan, habitual physical activity practice, BP, and treatment schedule. Conversely, there was a significant decrease in HR (8 sessions; $p < 0.03$) and glycemia (10 sessions; $p < 0.03$) immediately after the Yoga sessions. The immediate positive effect of Yoga practices on glycemia and HR suggests that such practices would be beneficial for the treatment of people with DM.

_____, **E. M. Olivera, A. Souto, M. L. Guidi, and J. J. Gagliardino.** Yoga practice in people with diabetes. CENEXA – Center of Experimental and Applied Endocrinology (UNLP-CONICET, PAHO/ WHO Collaborating Center), School of Medicine, National University of La Plata, La Plata, Buenos Aires, Argentina. Fax: 54 221 4222081, email: gagliardino@infovia.com.ar.

Aim: To evaluate the clinical and metabolic changes consecutive to daily yoga practices for 3 months in a group of people with diabetes (DM).

Material and Methods: Sixteen women (3 Type 1 DM, 12 Type 2 DM, 1 insulin-requiring DM; mean age 61 ± 11 years, DM history 21 ± 14 years) attending the Physical Activity Program at CENEXA were studied. The group of yoga practices, monitored by a yoga teacher, consisted in asanas, breathing, relaxation and meditation techniques. The sessions were carried out twice a week (total 27 sessions), complemented by sessions practiced daily by each individual the remaining days of the week. The data were recorded in questionnaires, including: 1) *Personal details:* demographic information, dietary and physical activity habits at the beginning and at the end of the study period. 2) *Medical registry:* clinical and metabolic characteristics, type of treatment and control, complications at the beginning and the end of the study. 3) *Follow-up:* arterial pressure (AP), cardiac frequency (CF) and glycemia at the beginning and at the end of 13 alternate sessions.

Results: There were no overall significant differences (beginning vs. end of the study) in BMI, HbA_{1c}, lipid profile, dietary plan, habitual physical activity practice, AP and treatment schedule. Conversely, there was a significant decrease in CF (9 sessions; $p < 0.03$) and glycemia (12 sessions; $p < 0.03$) during the sessions. Both attendance and compliance of the proposed schedule were high ($> 80\%$), excepting 2 people who deserted but completed 50% of the study.

Conclusion: The lack of significant changes in HbA_{1c} and in the other parameters studied may be the result of the short study-period evaluated. Probably, measurements after a longer study period may allow to remove some unhealthy habits, with the consequent modification in the referred parameters. The yoga practices described produce an immediate favorable change in metabolism (significant decrease of glycemia after the session) and in CF. Such effects could be secondary to a decrease in the activity of the adrenergic-sympathetic system, which appears increased in people with Type 2 DM. Therefore, the practice of yoga could be a beneficial component in the treatment of people with this type of DM.

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The Dr. Dean Ornish Program for Reversing Heart Disease accepts individuals with type 2 diabetes into the program, and the author recounts his extraordinary success. He weighted 370 lbs. when he began and initially had great resistance about participating, but is profoundly grateful that he did.

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Abstract: OBJECTIVES: 1. To study the effect of forty days of Yogic exercises on cardiac functions in Type 2 Diabetics. 2. To study the effect of forty days of Yogic exercises on blood glucose level, glycosylated hemoglobin. METHODS: The present study done in twenty-four Type 2 DM cases provides metabolic and clinical evidence of improvement in glycaemic control and autonomic functions. These middle-aged subjects were type II diabetics on antihyperglycaemic and dietary regimen. Their baseline fasting and postprandial blood glucose and glycosylated Hb were monitored along with autonomic function studies. The expert gave these patients training in yoga asanas and they pursued those 30-40 min/day for 40 days under guidance. These asanas consisted of 13 well known postures, done in a sequence. After 40 days of yoga asanas regimen, the parameters were repeated. RESULTS: The results indicate that there was significant decrease in fasting blood glucose levels from basal 190.08 +/- 18.54 in mg/dl to 141.5 +/- 16.3 in mg/dl after yoga regimen. The post prandial blood glucose levels decreased from 276.54 +/- 20.62 in mg/dl to 201.75 +/- 21.24 in mg/dl, glycosylated hemoglobin showed a decrease from 9.03 +/- 0.29% to 7.83 +/- 0.53% after yoga regimen. The pulse rate, systolic and diastolic blood pressure decreased significantly (from 86.45 +/- 2.0 to 77.65 +/- 2.5 pulse/min, from 142.0 +/- 3.9 to 126.0 +/- 3.2 mm of Hg and from 86.7 +/- 2.5 mm of Hg to 75.5 +/- 2.1 mm of Hg after yoga regimen respectively). Corrected QT interval (QTc) decreased from 0.42 +/- 0.0 to 0.40 +/- 0.0. CONCLUSION: These findings suggest that better glycaemic control and stable autonomic functions can be obtained in Type 2 DM cases with yoga asanas and pranayama. The exact mechanism as to how these postures and controlled breathing interact with somato-neuro-endocrine mechanism affecting metabolic and autonomic functions remains to be worked out.

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Abstract: Objective: Few multiple lifestyle behavior change programs have been designed to reduce the risk of coronary heart disease in postmenopausal women with type 2 diabetes. This study tested the effectiveness of the Mediterranean Lifestyle Program (MLP), a comprehensive lifestyle self-management program (Mediterranean low saturated fat diet, stress management training, exercise, group support, and smoking cessation), in reducing cardiovascular risk factors in postmenopausal women with type 2 diabetes. Research Design and Methods: Postmenopausal women with type 2 diabetes

(n=279) were randomized to either usual care (control) or treatment (MLP) conditions. MLP participants took part in an initial 3-day retreat, followed by 6 months of weekly meetings, to learn and practice program components. Biological end points were changes in HbA1c, lipid profiles, BMI, blood pressure, plasma fatty acids, and flexibility. Impact on quality of life was assessed. Results: Multivariate ANCOVAs revealed significantly greater improvements in the MLP condition compared with the usual care group on HbA1c, BMI, plasma fatty acids, and quality of life at the 6-month follow-up. Patterns favoring intervention were seen in lipids, blood pressure, and flexibility but did not reach statistical significance. Conclusions: These results demonstrate that postmenopausal women with type 2 diabetes can make comprehensive lifestyle changes that may lead to clinically significant improvements in glycemic control, some coronary heart disease risk factors, and quality of life.

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Of Related Interest

American Diabetes Association. Economic costs of diabetes in the U.S. in 2002. *Diabetes Care*, Mar 2003, 26(3):917-932. Article available for purchase online: <http://care.diabetesjournals.org/cgi/content/abstract/26/3/917?etoc>.

Abstract: Objective: Diabetes is the fifth leading cause of death by disease in the U.S. Diabetes also contributes to higher rates of morbidity—people with diabetes are at higher risk for heart disease, blindness, kidney failure, extremity amputations, and other chronic conditions. The objectives of this study were 1) to estimate the direct medical and indirect productivity-related costs attributable to diabetes and 2) to calculate and compare the total and per capita medical expenditures for people with and without diabetes. **Research Design and Methods:** Medical expenditures were estimated for the U.S. population with and without diabetes in 2002 by sex, age, race/ethnicity, type of medical condition, and health care setting. Health care use and total health care expenditures attributable to diabetes were estimated using etiological fractions, calculated based on national health care survey data. The value of lost productivity attributable to diabetes was also estimated based on estimates of lost workdays, restricted activity days, prevalence of permanent disability, and mortality attributable to diabetes. **Results:** Direct medical and indirect expenditures attributable to diabetes in 2002 were estimated at \$132 billion. Direct medical expenditures alone totaled \$91.8 billion and comprised \$23.2 billion for diabetes care, \$24.6 billion for chronic complications attributable to diabetes, and \$44.1 billion for excess prevalence of general medical conditions. Inpatient days (43.9%), nursing home care (15.1%), and office visits (10.9%) constituted the major expenditure groups by service settings. In addition, 51.8% of direct medical expenditures were incurred by people >65 years old. Attributable indirect expenditures resulting from lost workdays, restricted activity days, mortality, and permanent disability due to diabetes totaled \$39.8 billion. U.S. health expenditures for the health care components included in the study totaled \$865 billion, of which \$160 billion was incurred by people with diabetes. Per capita medical expenditures totaled \$13,243 for people with diabetes and \$2,560 for people without diabetes. When adjusting for differences in age, sex, and race/ethnicity between the population with and without diabetes, people with diabetes had medical expenditures that were ~2.4 times higher than expenditures that would be incurred by the

same group in the absence of diabetes. **Conclusions:** The estimated \$132 billion cost likely underestimates the true burden of diabetes because it omits intangibles, such as pain and suffering, care provided by non-paid caregivers, and several areas of health care spending where people with diabetes probably use services at higher rates than people without diabetes (e.g., dental care, optometry care, and the use of licensed dietitians). In addition, the cost estimate excludes undiagnosed cases of diabetes. Health care spending in 2002 for people with diabetes is more than double what spending would be without diabetes. Diabetes imposes a substantial cost burden to society and, in particular, to those individuals with diabetes and their families. Eliminating or reducing the health problems caused by diabetes through factors such as better access to preventive care, more widespread diagnosis, more intensive disease management, and the advent of new medical technologies could significantly improve the quality of life for people with diabetes and their families while at the same time potentially reducing national expenditures for health care services and increasing productivity in the U.S. economy.

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The Hu Hu Kam Memorial Hospital (Sacaton, Arizona) for those afflicted with diabetes, provides free treatment of basic services - physicals and eye exams, for instance - to anyone enrolled in a federally recognized tribe. It is working to provide a variety of services other than strictly medical to help those struggling with diabetes. A \$1 million wellness center opened in April with exercise equipment, yoga and tai chi classes, and free transportation to the center.

Egede, Leonard E., Xiaobou Ye, Deyi Zheng, and Marc D. Silverstein. The prevalence and pattern of complementary and alternative medicine use in individuals with diabetes. *Diabetes Care*, Feb 2002, 25(2):324-329.

Results: Individuals with diabetes were 1.6 times more likely to use CAM than individuals without diabetes (8 vs 5%, p, 0.0001) . . . Among individuals with diabetes, older age (>64 years) and higher educational attainment (high school education or higher) were independently associated with CAM use.

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“In recent years, conflicting studies linked cow's milk to diabetes in young children. Some studies found children who were given formula made with cow's milk were more likely to develop the disease, while other studies have shown no connection. Now researchers are getting to the bottom of this dietary dilemma . . .

“. . . [in the] TRIGR trial[,] [n]on-breastfed babies receive either standard formula or a special kind, called hydrolyzed formula.

“‘The two formulas are identical except for the fact that the one has the protein already broken down,’ says pediatric endocrinologist Dorothy Becker, M.B.B.C.H., of the Children’s Hospital of Pittsburgh.

“Dr. Becker says one theory suggests digesting proteins from cow’s milk before they break down may trigger diabetes. Studies in animals predisposed to diabetes surprised researchers.

“‘The results were dramatic. If you gave the rats and mice predigested formula, diabetes was prevented in 80 percent of them,’ says Dr. Becker . . .

“A study of 200 newborns found those who had formula without cow’s milk were 50 percent less likely to develop diabetes. Researchers from sites around the United States and the world will enroll nearly 3,000 participants. Children will be followed for 10 years to determine if they develop the disease.”

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Murphy, Simkins, and Helowicz. Diabetes exercise project. *Journal of Human Nutrition & Dietetics*, Apr 1999, 12(s1):79-90.

Abstract: *Background:* Exercise can play a major role in improving diabetic control and prevention of complications. In order to encourage overweight people with poorly controlled diabetes to take more exercise a group exercise programme was set up. *Objectives:* To evaluate the effectiveness of the diabetes exercise project 20 months after professional contact and funding had ceased. The project ran from October 1994 to March 1996 and the evaluation was carried out in November 1997. *Method:* Evaluation was carried out through a postal questionnaire, focus group discussions and clinical data collection on a sample of those referred on to the project. The project set out to find: (1) the number of the original group who took up the exercise programme and were still exercising on a regular basis; (2) the clinical outcomes in terms of changes in body mass index (BMI), glycosylated haemoglobin (HbA1) and diabetes medication from the start of the exercise project to the evaluation; (3) the self-reported benefits to those with diabetes on the exercise programme, including any self-reported effect regular exercise has had on their diabetes control at the time of the evaluation; (4) the factors associated with their ability to carry on exercising. *Results:* Clinical outcomes showed no significant changes in those who continued to exercise and those who stopped. However, there was a statistically significant increase ($P = 0.01$) in the proportion of those with non-insulin dependent diabetes (NIDDM) who were treated with insulin, from 30% to 53%. Of the 42 who had replied to the questionnaire, 71% continued to exercise for more than 6 months and, of these, 52% continued to exercise for over 20 months. Self-reported benefits of exercise included “increased energy levels,” a greater ability to concentrate and enjoy

exercise, increased motivation and more positive mood and feelings. Improvement in diabetic control was reported by 25 (60%). Further benefits reported included a stabilizing of their diabetes, loss of weight and a more positive attitude towards their health. *Conclusions:* It is possible to motivate overweight, poorly controlled people with diabetes to exercise on a regular basis. To do so successfully, consideration needs to be given to having the right personnel involved in the exercise programmes, support from the health professionals and suitable facilities and instruction. Injury and lack of time were given as the main barriers to exercise.

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<http://care.diabetesjournals.org/cgi/reprint/25/1/30.pdf>.

Abstract:

Objective—There is conflicting evidence regarding the utility of stress management training in the treatment of diabetes. The few studies that have shown a therapeutic effect of stress management have used time-intensive individual therapy. Unfortunately, widespread use of such interventions is not practical. The aim of the present investigation is to determine whether a cost-effective, group-based stress management training program can improve glucose metabolism in patients with type 2 diabetes and to determine whether a particular subset of patients is more likely to get positive results.

Research Design and Methods—Patients with type 2 diabetes were randomized to undergo a five-session group diabetes education program with or without stress management training*. Participants ($n = 108$) were followed for 1 year, during which HbA_{1c} tests and questionnaires assessing perceived stress, anxiety, and psychological health were administered at regular intervals to evaluate treatment effects.

Results—Stress management training was associated with a small (0.5%) but significant reduction in HbA_{1c}. Compliance with the treatment regimen decreased over time but was

similar to that seen in patients receiving stress management for other reasons in the clinic. Trait anxiety (a measure of stable individual differences in anxiety proneness) did not predict response to treatment, showing that highly anxious patients did not derive more benefit from training.

Conclusions—The current results indicate that a cost-effective, group stress management program in a “real-world” setting can result in clinically significant benefits for patients with type 2 diabetes.

*** Stress management program**

The stress management program included 1) PMR training, 2) instruction in the use of cognitive and behavioral skills to recognize and reduce physiological stress levels (such as recognition of major stressors in life, guided imagery, thought-stopping, and deep breathing), and 3) education on the health consequences of stress. PMR training consisted of consecutively tensing and relaxing a prescribed set of muscle groups in the body, starting with the feet and progressing through the head, with specific attention paid to tense regions of the body. This was combined with techniques such as deep breathing and mental imagery to produce a deeply relaxed state of mind and body.

Participants learned PMR in part by listening to an audiotape during each group session. They also were instructed to practice muscle relaxation at home twice daily with the aid of the tape, first using a longer exercise to achieve relaxation and then advancing to a shorter version. After some skill was developed, mini-practices were introduced. Mini-practices are a brief, 30-s version of a PMR session using deep breathing and imagery. Incorporation of mini-practices into daily life to maintain a relaxed body and mind is the eventual goal of PMR training. Participants were instructed to engage in mini-practices at least two times per hour. During the last session, patients were encouraged to keep practicing their acquired skills during the remainder of the study. This included incorporating frequent mini-practices into daily life as well using the relaxation tape during more stressful periods or when their skills needed enhancement. During the follow-up assessments at 2, 4, 6, and 12 months, patients in the treatment group were asked how many times they listened to the audiotape in a typical week and how frequently they used mini-practices in a typical day.

Toobert, Deborah J., Russell E. Glasgow, Lisa A. Strycker, Manuel Barrera, Jr., Janice L. Radcliffe, Rosemary C. Wander, and John D. Bagdade. Biologic and Quality-of-Life Outcomes From the Mediterranean Lifestyle Program. *Diabetes Care*, 2003, 26(8):2288-2293. Author email: deborah@ori.org.

Abstract: **OBJECTIVE:** Few multiple lifestyle behavior change programs have been designed to reduce the risk of coronary heart disease in postmenopausal women with type 2 diabetes. This study tested the effectiveness of the Mediterranean Lifestyle Program (MLP), a comprehensive lifestyle self-management program (Mediterranean low-saturated fat diet, stress management training, exercise, group support, and smoking cessation), in reducing cardiovascular risk factors in postmenopausal women with type 2 diabetes. **RESEARCH DESIGN AND METHODS:** Postmenopausal women with type 2 diabetes (n = 279) were randomized to either usual care (control) or treatment (MLP)

conditions. MLP participants took part in an initial 3-day retreat, followed by 6 months of weekly meetings, to learn and practice program components. Biological end points were changes in HbA1c, lipid profiles, BMI, blood pressure, plasma fatty acids, and flexibility. Impact on quality of life was assessed. RESULTS: Multivariate ANCOVAs revealed significantly greater improvements in the MLP condition compared with the usual care group on HbA1c, BMI, plasma fatty acids, and quality of life at the 6-month follow-up. Patterns favoring intervention were seen in lipids, blood pressure, and flexibility but did not reach statistical significance. CONCLUSIONS: These results demonstrate that postmenopausal women with type 2 diabetes can make comprehensive lifestyle changes that may lead to clinically significant improvements in glycemic control, some coronary heart disease risk factors, and quality of life.

Tsujiuchi, Takuya, Hiroaki Kumano, Kazuhiro Yoshiuchi, DeGuang He, Yuko Tsujiuchi, Tomifusa Kuboki, Hiroyuki Suematsu, and Koichi Hirao. The effect of Qi-Gong relaxation exercise on the control of type 2 Diabetes Mellitus: A randomized controlled trial. *Diabetes Care*, Jan 2002, 25(1):241-242.

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Conclusions: Although BMI and physical inactivity are independent predictors of incident diabetes, the magnitude of the association with BMI was greater than with physical activity in combined analyses. These findings underscore the critical importance of adiposity as a determinant of diabetes.

Zacker, Ronald J. Exercise: A key component of diabetes management. *Diabetes Spectrum*, 2004, 17(3):142-144.

Excerpt: "Exercise has long been recognized as an essential component of diabetes management. Elliot Joslin once referred to exercise as 'the second steed in the diabetic's three-horse chariot,' sharing equal billing with diet and insulin. Subsequent generations of diabetes practitioners have established exercise as one of the four cornerstones of care (along with diet, medication, and monitoring) and have come to learn a great deal more about the mechanisms by which exercise is able to provide such profound benefits for physical health.

"Atherosclerotic vascular disease remains the number one killer of people with diabetes, and research has shown exercise to be of tremendous utility in its treatment. It is known that exercise ameliorates many of the known vascular disease risk factors, favorably influencing levels of blood pressure, LDL cholesterol, HDL cholesterol, triglycerides, and glycemia.

“More recent research suggests that exercise may exert similarly favorable effects on emerging vascular disease risk factors as well, including thrombosis, endothelial function, and levels of C-reactive protein.

“Exercise is perhaps the best therapy for the prevention of both type 2 diabetes and the metabolic syndrome. Exercise appears to aid in the loss of visceral fat, quite literally getting to the core of the metabolic syndrome. Results of the Diabetes Prevention Program demonstrated that as little as 150 minutes per week of moderate exercise as part of a lifestyle intervention significantly decreased the progression of type 2 diabetes in patients with preexisting impaired glucose tolerance. These findings were comparable to those of the Finnish Diabetes Prevention Study.

“The magic bullet–like ability of exercise to counter much of the metabolic disruption and ensuing pathology occurring in diabetes is beyond remarkable and has understandably led to greater emphasis being placed on the physiological benefits of exercise . . .”

Ongoing Research

Dr. Jasmin Diwan and Dr. Chinmay Shah

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Planning research on the effect of Yoga on diabetes. Contacted IAYT 12/19/02.

Nancy Ferguson

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Is a Yoga teacher working with a group seeking funding for Yoga for obese persons with diabetes. Contacted IAYT 1/22/03.

Guru Ram Das Center for Medicine & Humanology in collaboration with the California Pacific Medical Center, San Francisco

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The center has eight proposals out to study the effect of Sat Nam Rasayan on people with diabetes.

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Researching the effect of Yoga on diabetes.