

Evaluate the Effect of Yoga Therapy on Reaction Time, Biochemical Parameters and Wellness Score of Peri and Post-Menopausal Diabetic Patients

Kedar Suresh Kulkarni

Assistant Professor, RCSM GMC Kolhapur, Maharashtra, India

Received: 15-02-2023 / Revised: 18-03-2023 / Accepted: 01-04-2023

Corresponding author: Dr Kedar Suresh Kulkarni

Conflict of interest: Nil

Abstract

Background: There are many positive effects of yoga on one's health. The purpose of this research was to determine whether or not yoga therapy improved the response time, metabolic markers, and wellbeing score of diabetes patients who were either perimenopausal or postmenopausal.

Material & Methods: Fifteen women were selected for this study; all had type 2 diabetes and were under medical supervision. Reaction times, fasting and postprandial blood glucose levels, and lipid profiles were measured before and after a six-week, three-times-a-week yoga therapy program. Using a questionnaire created by ACYTER to assess post-therapy well-being, their feelings were compared.

Results: The sensitivity of pancreatic b cells to glucose signals can shift, or the body might become less resistant to the effects of insulin. Our patients were peri and post-menopausal, making the reduction in cardiovascular risk profile due to yoga all the more significant given the recently identified "heart-friendly" lipid profiles.

Conclusion: A comprehensive yoga therapy program may complement conventional medical treatment for diabetes mellitus, or it may be used instead.

Keywords: Type 2 diabetes, pancreatic b cells, postprandial blood glucose levels, lipid profiles.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Yoga therapy refers to the use of yoga techniques to the therapy of medical conditions. Individualized yoga routines including asanas, pranayama, and savasana are prescribed by yoga therapists [1-3]. The difficulties might be caused by anything short-term, like sickness or pregnancy, or long-term, such old age or disability.

Physical and mental well-being may be enhanced by yoga therapy's use of asanas (yoga postures), pranayama (breathing exercises), meditation, and guided imagery. Yoga therapy, with its emphasis on the whole

person, promotes harmony between body, mind, and soul. Modern yoga therapy encompasses a wide variety of therapy techniques, drawing both physical and psychological approaches [4-7].

Yoga has been shown to be an effective therapy for decreasing high blood pressure in certain people. Yoga asana is a calming activity that helps decrease stress, a major contributor to hypertension [8-12].

Material and Methods: This study is part of a larger inquiry into the effects of yoga

treatment on DM, and was conducted in compliance with the criteria established by the institute's Research and Ethics Councils. Informed permission was collected from 15 female patients ranging in age from 36 to 63 (50.40 ± 2.47 SEM) who were undergoing medical therapy for type 2 DM at KOHLAPUR. Yoga was completely new to all of the patients. Out of the total, 11 had been menopausal for over a year, while the other 4 were in the early stages. Four of them had hypertension, three had musculoskeletal problems, and seven had nervous system issues. Participants were not included if they had a history, symptoms, or test results that indicated a risk for nephrologic and ophthalmologic problems. The following measures were taken both at the beginning and end of the study's six-week duration.

Reaction time

The device's digital chronometer is accurate to within 1 ms. There are two response buttons, a "ready" light, and four inputs to choose from. For each stimulus, a toggle allows the user to choose either the right or left response key. In a soundproof laboratory, recordings were taken two hours after a light breakfast. So that they wouldn't be swayed to one side by only auditory or visual cues, subjects were instructed to respond first with their right hands and then their left. The acoustic startle response time (ART) and the visual response time (VRT) of the individuals were measured. Once they were aware of the stimuli, participants were instructed to stop pressing the response key. Individuals were taught to respond with their dominant hands to frontal impulses to lessen the effect of a lateralized stimulus [14,15]. There were two practice runs through the reaction time equipment for each competitor. This was done because RT becomes more consistent as practitioners gain expertise. In [16], The precision of the RT measurement was 1 ms. When there were more than 10 trials recorded, a three-sample mean was used.

Biochemical investigations

After absorption, blood was collected from an antecubital vein for biochemical studies at the institute's Central Lab. Participants were requested to refrain from yoga on the day their blood was taken. Fasting blood glucose (FBG), 2-h postprandial blood glucose (PPBG), and lipid profile (total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL), low density lipoprotein (LDL), and very low density lipoprotein (VLDL)) were all measured in all participants before and after the study period.

Wellness questionnaire

To assess the patients' relative well-being after the therapy, ACYTER developed a retrospective wellness questionnaire. A five-point scale from "worse than before" to "complete relief/total satisfaction" was used to assess the patient's progress in terms of their physical and mental health. A group of 12 people, including 3 highly regarded doctors, 2 psychologists, 2 yoga specialists, 2 yoga therapy consultants, 2 educators, and 1 legal anthropologist, collaborated to finish the questionnaire.

Yoga therapy program

At their first appointments at the ACYTER Yoga OPD, patients received yogic counseling and advice on how to lead a healthier life. They next participated in ACYTER's specialized programs for diabetics. Patients at ACYTER were taught yoga by certified teachers for an hour, three times a week, for a total of six weeks as part of a therapeutic yoga program. Table 1 provides the timetable for the event. Patients were encouraged to work at their own pace and not push themselves beyond their capabilities. Attendance at all 18 sessions providing direct supervision was 99.63%. Patients were also advised to continue their exercise routines at home on days when they did not get treatment. Five of the 15 patients

said they did it at home four or more times a week, four said they did it three times a week, and two said they did it twice a week. Three patients reported doing home practice on five, six, and seven days per week, respectively; one patient reported doing no home practice. According to the data, nine patients spend 30 minutes on home practice, three spend 60 minutes, and two spend 40 minutes.

Data Analysis

The Kolmogorov-Smirnov test was used to determine whether the data was normally distributed, and the results were positive. Students t (paired) test was used for statistical analysis, and P values less than 0.05 were

considered to indicate a statistically significant difference between baseline and post-intervention measurements.

Results

Reaction time

Yoga was found to reduce right- and left-hand ART and VRT. Only ART performed with the right hand had a significant reduction ($P=0.0357$), going from 196.87 ± 9.25 to 178.04 ± 6.36 ms. Significant (7.18%) but not statistically significant ($P=0.0583$) was the reduction in left-hand visual. There were no statistically significant difference between the right and left hand in terms of VRT reduction [Table 1].

Table 1: Right and left-hand visual and auditory response times were measured before and after a six-week course of yoga therapy in individuals with type 2 diabetes mellitus

Before	VRT (ms)	Right hand	Left hand	ART (ms)	Right hand	Left hand
		250.82 ± 7.42	259.80 ± 7.72		196.87 ± 9.25	193.31 ± 6.19
After		241.07 ± 5.92	251.44 ± 4.20		178.04 ± 6.36	179.44 ± 5.03
P value		-3.89	-3.22		-9.56	-7.18
% change		0.1096	0.1931		0.0357	0.0583

Values are mean \pm SEM for 15 subjects

Biochemical Results

Fasting blood sugar levels decreased by 20.62 percent, from 160.07 ± 15.65 to 127.07 ± 10.24 mg/dl ($P=0.0035$). The decrease in PPBG from 244.20 ± 17.12 to 208.73 ± 16.07 mg/dl was statistically significant ($P=0.0012$), representing a 14.52 percent decline. There was a substantial drop in TC levels (5.14 percentage points; $P=0.016$), from 161.24 ± 9.10 to 152.95 ± 7.17 mg/dl. In addition, TG decreased by 9.89%, from 110.53 ± 10.56 to 99.60 ± 8.37 mg/dl ($P=0.020$), LDL decreased by 10.64%, from 96.53 ± 9.46 to 86.27 ± 7.78 mg/dl

($P=0.0012$), and VLDL decreased by 9.77%, from 22.11 ± 2.11 to 19.95 ± 1.67 mg/dl ($P=0.020$). On the other hand, HDL levels increased by 10.49%, from 42.60 ± 5.16 to 47.07 ± 5.08 mg/dl ($P=0.022$). The ratio of total cholesterol to high-density lipoprotein dropped by 17.37% ($P=0.003$) while the ratio of low-density lipoprotein to high-density lipoprotein dropped by 22.41% ($P=0.005$). The HDL/LDL ratio increased by 19.13%, from 0.65 ± 0.21 to 0.77 ± 0.24 , which is statistically significant ($P=0.016$).

Table 2: Patients with type 2 diabetes mellitus were evaluated before and after a six-week yoga therapy program for its effect

Before	FBG (mg/dl)	PPBG (mg/dl)	TC (mg/dl)	TG (mg/dl)	LDL (mg/dl)	VLDL (mg/dl)	HDL (mg/dl)	TC/HDL	LDL/HDL	HDL/LDL
	160.07 ± 15.65	244.20 ± 17.12	161.24 ± 9.10	110.53 ± 10.56	96.53 ± 9.46	22.11 ± 2.11	42.60 ± 5.16	4.36 ± 0.46	2.77 ± 0.40	0.65 ± 0.21
After	127.07 ± 10.24	208.73 ± 16.07	152.95 ± 7.17	99.60 ± 8.37	86.27 ± 7.78	19.95 ± 1.67	47.07 ± 5.08	3.60 ± 0.31	2.15 ± 0.27	0.77 ± 0.24
P value	0.0035	0.0012	0.0161	0.0203	-10.64	-9.77	10.49	-17.37	-22.41	19.13
% change	-20.62	-14.52	-5.14	-9.89	0.0012	0.0222	0.0229	0.0035	0.0059	0.0165

Values are mean±SEM for 15 subjects

Wellness questionnaire

The percentage of participants who answered each question and their average assessments of happiness after the intervention are shown in Table 3. Seven percent reported feeling "completely better" after finishing the treatment program, while another 27 percent reported feeling "much better" than previously. Of those surveyed, 42% said they were in better health than previously, while 23% said they felt the same. One percent were in far poorer shape than before.

Table 3: Percentage of individuals whose wellbeing improved after completing a retrospective questionnaire

	Ability to concentrate	Control of anger/ loss of temper	Appetite	Confidence level	Ease of breathing	Energy levels	Enjoyment of life	Feeling calm and fresh	Feeling of hopelessness	Feeling of loneliness	General flexibility	General mood
Worse than before	-	-	-	-	-	-	-	-	-	-	-	-
Same as before	28.57	35.71	33.33	28.57	26.67	33.33	20	33.33	40	6.67	13.33	8.33
Better than before	50	28.37	25	42.86	40	33.33	60	33.33	40	60	53.33	50

Much better than before	21.43	28.57	25	21.43	26.67	33.33	6.67	26.67	20	33.33	26.67	33.33
Complete relief/ totally satisfied	-	7.14	16.67	7.14	6.67	-	13.33	6.67	-	-	6.67	8.33

	General sense of relaxation	General wellbeing	Joint mobility	Nervousness	Normality of menstrual cycles	Pain levels	Performance of day-to-day activities	Sleep quality/duration	Stress levels
Worse than before	-	-	-	-	-	-	-	13.33	9.09
Same as before	14.28	7.69	13.33	28.57	25	13.33	21.43	20	27.27
Better than before	50	38.46	40	57.14	25	53.33	42.86	26.67	36.36
Much better than	28.57	53	33.33	14.29	-	26.67	35.71	40	27.27
Complete relief/ totally	7.14	-	13.33	-	50	6.67	-	-	-

Total score of wellbeing: 22.80, 1.07, 26.76, 42.19, 7.13

Discussion

Here, we demonstrate that a sustained six-week yoga therapy program dramatically

lowers ART in people with diabetes. This is the first report of its kind to our knowledge.

Faster sensory-motor conduction velocity and/or more efficient information processing in the central nervous system may account for shorter response times (RTs) [11].

Our subjects' fasting and post-meal blood sugar levels dropped significantly after they finished the yoga therapy program. This is consistent with earlier studies indicating that regular yoga practice improves glycemic control and decreases both fasting and postprandial blood glucose [12,13].

In 2015, researchers employed a Quasi-experimental approach that included giving each group a test before and after the study proper. Sixty people with primary hypertension were chosen (30 for the trial and 30 for the control group). The control group did not do the abdominal breathing exercises twice daily for 10 days. The patient's clinical and socio-demographic information was gathered using an interview schedule. The stethoscope and sphygmomanometer were used to check the patient's blood pressure. The data was analyzed using descriptive statistics, the t test, and analysis of variance. In the experimental group, blood pressure dropped significantly ($p = 0.001$). Hypertensive individuals' blood pressure was shown to be significantly correlated with their age. Research shows that hypertension individuals may benefit from a supplementary treatment consisting of abdominal breathing exercises to lower their blood pressure [14].

The adult hypertension prevalence in a population-based research. There were a total of 30 papers found that reported the prevalence of hypertension in 33,143 individuals; all had been examined by experts in the field. Ibero-American rural areas had a crude hypertension prevalence of 32.6% (95% CI, 31.4-32.5%; range, 1.8-52%). Native American groups had a prevalence of hypertension that was much lower than the national average (19.5% vs. 36%).

Hypertension awareness, treatment, and control were only evaluated in nine trials (mean 54%, 57%, and 14%). Abdominal obesity (39%) and excess weight (39%), both major risk factors for cardiovascular disease, were the most common. Findings suggest that hypertension is underdiagnosed, undertreated, and undercontrolled in rural Ibero-America and the Caribbean, where the research focused. Effective interventions for the prevention, diagnosis, treatment, and management of hypertension are urgently required in this area [15].

With 11 postmenopausal and 4 pre- and perimenopausal patients, our results of an improved lipid profile status are particularly noteworthy. With ovaries no longer producing eggs, postmenopausal women are at a higher risk for cardiovascular disease due to abnormalities in their glucose and insulin metabolism and lipid profile [16]. Women with diabetes have a 5 times higher risk of developing heart disease, and the 'female edge' over men in terms of coronary heart disease disappears after they reach menopause, according to research. The importance of the improvements in lipid profile in our perimenopausal diabetes women is therefore emphasized [17].

The subjective well-being ratings of participants in a brief lifestyle change and stress management educational program have been shown to increase significantly, suggesting that this kind of program may play a useful role in the primary prevention and treatment of lifestyle illnesses. [18] The majority of our patients saw dramatic improvements in their appetite, concentration, anger management skills, confidence, breathing, energy, and overall sense of peace and freshness. Hopelessness, anxiety, and isolation were also observed to decrease. They felt happier, more relaxed, and healthier overall, and their flexibility and joint mobility improved. All four pre- and peri-menopausal patients had a return to

regular menstrual periods. Better sleep, both in terms of length and quality, has been linked to lower stress levels. This is consistent with a previous study showing that yoga improves mental health and decreases anxiety in people with type 2 diabetes.[19] Positive changes seen in our patients may be attributable, in part, to the psychophysiological effects of yoga on the patients' minds and hearts, as stated by our participants.

This is a topic that requires further research. It's interesting that the one person who didn't do any home practice had her medicine rise and the one who did daily home practice saw her medication decrease. Both participants reported increases in their well-being after completing the questionnaire, but the daily practitioner reported significantly higher levels of improvement ('far better' to 'complete alleviation') than the other participant ('same' to 'better') [20].

Our research suggests the following hypotheses about the contributions of the various activities we examined. Surya namaskar strengthens the muscles and increases metabolic function, making it easier to burn off sugar that the body doesn't need.

Conclusion

Overall, our research reveals that peri and postmenopausal diabetes patients may benefit greatly from a six-week yoga therapy training program in terms of their response speed, blood glucose levels, and lipid profiles. The positive benefits of conventional medical care of DM may be amplified with the addition of an extensive yoga therapy program, which may be employed as part of a powerful complementary or integrative treatment plan.

References

1. Bhavanani AB, Are we practicing yoga therapy or yogopathy? *Yoga Therapy Today*, 2011; 7(1): 26-28.
2. Sharma R, Gupta N & Bijlani R, Effect of yoga based lifestyle intervention on subjective well being, *Indian J Physiol Pharmacol*, 2008; 52(2): 123-31.
3. Sundar S, Agrawal SK, Singh VP, Bhattacharya SK, Udapa KN *et al*, Role of yoga in management of essential hypertension, *Acta Cardiol*, 1984;39(3): 203-08.
4. Chhabra MK, Lal A & Sharma KK, Status of lifestyle modifications in hypertension, *J Indian Med Assoc*, 2001;99: 504-8.
5. Innes KE, Bourguignon C & Taylor AG, Risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with yoga: a systematic review, *J Am Board Fam Pract*, 2005; 18(6): 491-519.
6. Vijayalakshmi P, Madanmohan, Bhavanani AB, Patil A & Babu K, Modulation of stress induced by isometric handgrip test in hypertensive patients following yogic relaxation training, *Indian J Physiol Pharmacol*, 2004; 48(1): 59-64.
7. Kaplan NM, Hypertension curriculum review: lifestyle modifications for prevention and therapy of hypertension, *J Clin Hypertension*, 2004; 6(12):716-19.
8. Prakash ES, Madanmohan, Sethuraman KR & Narayan SK Cardiovascular autonomic regulation in subjects with normal blood pressure, high-normal blood pressure and recent-onset hypertension, *Clin Exp Pharmacol Physiol*, 2005; 32(5-6): 488-94.
9. Hegde SV, Adhikari P, Kotian S, Pinto VJ, D'Souza S *et al*, Effect of 3-Month Yoga on Oxidative Stress in Type 2 Diabetes With or Without Complications: A controlled clinical

- trial, *Diabetes Care*, 2011; 34(10): 2208-10.
10. Gokal R, Shillito L & Ramdev S, Positive impact of yoga and pranayam on obesity, hypertension, blood sugar, and cholesterol: a pilot assessment, *J Altern Complement Med*, 2007; 13(10): 1056-1058.
 11. Telles S, Naveen VK, Balkrishna A & Kumar S, Short term health impact of a yoga and diet change program on obesity, *Med Sci Monit*, 2010;16: CR35-40.
 12. Udupa K, Madanmohan, Bhavanani AB, Vijayalakshmi P & Krishnamurthy N, Effect of pranayam training on cardiac function in normal young volunteers, *Indian J Physiol Pharmacol*, 2003; 47(1): 27-33.
 13. Innes KE & Vincent HK The Influence of yoga-based programs on risk profiles in adults with type 2 diabetes mellitus: A systematic review, *eCAM*, 2007; 4(4): 469-486.
 14. Selvamurthy W, Sridharan K, Ray US, Tiwary RS, Hegde KS, *et al*, A New physiological approach to control essential Hypertension, *Indian J Physiol Pharmacol*, 1998; 42(2): 205-213.
 15. Madanmohan, Rai UC, Balvittal V, Thombre DP & Swami Gitananda, Cardiorespiratory changes during Savitri pranayam and shavasan, *The Yoga Review*, 1983;3: 25-34.
 16. Gobel FL, Norstrom LA, Nelson RR, Jorgensen CR & Wang Y, The rate-pressure product as an index of myocardial oxygen consumption during exercise in patients with angina pectoris, *Circulation*, 1978; 57(3): 549-56.
 17. Pal A, Srivastava N, Tiwari S, Verma NS, Narain VS *et al*, Effect of yogic practices on lipid profile and body fat composition in patients of coronary artery disease, *Complementary Therapies in Medicine*, 2011; 19(3): 122-127.
 18. Madanmohan, Prakash ES & Bhavanani AB. Correlation between short-term heart rate variability indices and heart rate, blood pressure indices, pressor reactivity to isometric handgrip in healthy young male subjects, *Indian J Physiol Pharmacol*, 2005; 49(2):132-38.
 19. Gordon AL, Morrison YE, Mc Growder AD, Young R, Fraser YT *et al*, Effect of exercise therapy on lipid profile and oxidative stress indicators in patients with type 2 diabetes, *BMC Complementary and Alternative Medicine*, 2008;13: 8-21.
 20. Bijlani RL, Vempati RP, Yadav RK, Ray RB, Gupta V *et al*, A brief but comprehensive lifestyle education program based on yoga reduces risk factors for cardiovascular disease and diabetes mellitus, *J Altern Complement Med*, 2005; 11(2): 267-74.
 21. Damodaran A, Malathi A, Patil N, Shah N, Suryavanshi *et al*, Therapeutic potential of yoga practices in modifying cardiovascular risk profile in middle aged men and women, *J Assoc Physicians India*, 2002; 50(5): 633-640.