International Journal of Research in Medical Sciences
Shrivastava N et al. Int J Res Med Sci. 2018 Sep;6(9):3080-3083
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20183648

Original Research Article

Effects of yoga in modifying blood pressure in patients of type 2 diabetes mellitus

Namita Shrivastava[1], Basant Kumar Maheswari[2]*, Debapriya Rath[3], Debashree Sarkar[1]

[1]Department of Physiology, [2]Department of Pharmacology, [3]Department of Biochemistry, Pt. J. N. M. Medical College, Raipur, Chhattisgarh, India

Received: 03 July 2018
Accepted: 27 July 2018

***Correspondence:**
Dr. Basant Kumar Maheswari,
E-mail: drbkm125@gmail.com

ABSTRACT

Background: The incidence of diabetes mellitus is increasing with the increase in unhealthy dietary habits, physical inactivity and sedentary lifestyle. Hypertension complicated with diabetes further aggravates the problem. Yoga has been found to be helpful in delaying the progression and complications of the disease. The present study was undertaken with an aim to evaluate the effect of yoga in modifying blood pressure in patients of diabetes mellitus.
Methods: Thirty patients of diabetes mellitus who were known case of hypertension were taken and their fasting and post-prandial blood glucose levels, systolic and diastolic blood pressure and waist circumference were analysed before and after ninety days of yoga in the department of physiology and biochemistry.
Results: Systolic and diastolic blood pressure, waist circumference and fasting and post-prandial blood glucose level showed significant reduction (p value <0.05).
Conclusions: This study emphasizes the importance of yoga in the control and management of type 2 diabetes mellitus and hypertension.

Keywords: Diabetes mellitus, Glucose tolerance, Hypertension, Metabolic syndrome, Yoga

INTRODUCTION

Diabetes mellitus is one of the most important metabolic disorder that affects nearly every organ system in the body, characterized by the chronic state of hyperglycemia due to defective insulin action or production by pancreatic β-cells.[1] It is not a single disease entity as thought earlier, but a syndrome that affects almost every organ system of our body, mainly vascular, renal, nervous system and retina of the eye.[2]

Diabetes mellitus can be classified broadly as type 1 DM and type 2 DM. Type 1 DM is the result of complete or near total insulin deficiency. Type 2 DM is a heterogeneous group of disorders characterized by variable degrees of insulin resistance, impaired insulin secretion and increased glucose production. Most patients of type 2 DM are obese, and obesity itself causes some degree of insulin resistance. Core features of the insulin resistance syndrome are glucose intolerance, insulin resistance, atherogenic dyslipidemia, visceral adiposity and high blood pressure.[3] Increased sympathetic activity, enhanced cardiovascular reactivity and reduced parasympathetic tone have also been implicated in the development and progression of type 2 DM and related cardiovascular complications.[4-5]

Hypertension has been identified as a major risk factors for the development of diabetes. The prospective cohort study found that type 2 DM was almost 2.5 times as likely to develop in subjects with hypertension as in subjects with normal blood pressure.[6] Increased waist

circumference has also been identified as a risk factor for DM.[7] Physical inactivity has been identified as a stronger predictor of the chronic diseases such as DM than other risk factors such as hypertension, hyperlipidemia and obesity for all cause mortality.[8] Changes in work patterns from heavy labour to sedentary, the increase in computerization and mechanization, and improved transport are just a few of the changes that have had an impact on human metabolism.[9]

Regular physical activity offers protection against and may be useful as an adjunct treatment along with regular medication for a wide variety of, chronic diseases associated with low grade inflammation like diabetes. Yoga is a mind body approach and have been studied in diabetes as means of decreasing stress-related hyperglycemia.[10-12] Asanas are body postures held for 5-20 breaths, and pranayamas are controlled abdominal and diaphragmatic breathing movements.[13] Even though yoga practices are known to bring down the blood glucose and oxidative stress, very scanty literature is available to see the beneficial effects of yoga on diabetes mellitus.

METHODS

The present study has been done as part of a study to see the effects of yoga on blood glucose insulin metabolism in patients of diabetes mellitus conducted at Pt. J.N.M. Medical College, Raipur (C.G.) during March 2012 to October 2013 after taking ethical clearance from ethical committee.

Inclusion criteria

This was an observational study which included 30 subjects (excluding drop outs) of Diabetes Mellitus having Hypertension in the age group of 30-60 years who had enrolled newly to the Patanjali Yoga Sansthana, Raipur. Patients with Diabetes of at least 2 years duration and on regular medical management were included in the study to rule out the bias because of the drug therapy. Subjects who have signed informed consent and had registered within seven days of the first sample taken were included in the study.

Exclusion criteria

Subjects who were known case of retinopathy, cardiac complications, neurological problems or any other known complication of diabetes mellitus or any other major systemic pathology were excluded from the study. Patients who discontinued yoga for a period of more than 7 days or more than two occasions of less than 7 days were excluded from the study.

The study subjects were assessed before and after 90 days of yoga. The patients did yoga daily for 40-45 minutes in the morning. Thirteen asanas (surya namaskar, tadaasan, trikonasana, paschimottanaasan, vajraasan, mandukaasan, dhanurasana, ardhmatsyendrasana, pavanamuktasana, bhujangasana) and pranayama (bhastrika, anulom vilom) and deep relaxation (shavaasan) were done by them. Their Blood Pressure both systolic and diastolic were recorded by using sphygmomanometer and stethoscope in supine position. Their fasting and post prandial blood glucose were assessed by glucose oxidase peroxidase method using fully automated biochemistry analyzer in the department of biochemistry. Their waist circumference was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest, using a stretch resistant tape that provides a constant tension, with the tape parallel to the floor, the subject standing with feet close together, arms at the side and body weight evenly distributed. The measurements were taken at the end of a normal expiration. During the study they were continued on the same drugs they were taking.

RESULTS

Table 1 shows the values of systolic and diastolic blood pressure, fasting and post-prandial blood sugar and waist circumference before and after yoga. All the parameters were treated as continuous variables and expressed as mean±SD. Students paired t-test was used to compare the data and calculation of significance. Microsoft excel and graphpad calculator were used for the statistical calculations. A p-value <0.05 was considered statistically significant.

Table 1: Comparison of physiological and clinical parameters before and after yoga.

	Pre- Yoga Mean±SD	Post- Yoga Mean±SD	p- value
Systolic BP (mmHg)	140.33±13.69	130.67±12.51	0.01*
Diastolic BP (mmHg)	83.33±11.05	77.33 ±10.48	0.03*
FBG (mg/dl)	122.43±47.73	99.15±34.86	0.03*
PPBG (mg/dl)	204.46±29.66	189.63±27.37	0.04*
Waist circumference (cm)	101.33±10.60	99.63±10.53	0.5

The results showed that the mean systolic blood pressure had significantly reduced from 140.33±13.69 (before yoga) to 130.67±12.51 (after yoga). The mean diastolic blood pressure also significantly reduced from 83.33±11.05 (before yoga) to 77.33±10.48 (after yoga). The significant reduction in blood pressure shows the

positive effect of yoga in controlling blood pressure. Seventy nine percent of the subjects were male and 21% were females. This shows that diabetes is more common in men than women. Eighty seven percent of the patients have positive family history of Diabetes mellitus. Age is another high-risk factor for Type 2 Diabetes mellitus. All the subjects were above 40 years of age and they reported decrease in anxiety and stress after yoga. They also showed feeling of well-being after yoga. The fasting blood glucose showed significant reduction from 122.43±47.73 (before yoga) to 99.15±34.86 (after yoga). The post-prandial blood glucose showed significant reduction from 204.46±29.66 (before yoga) to 189.63±27.37 (after yoga). Subjects showed better glycemic control after yoga. There were no dietary and drug modifications prescribed to the patients as a part of the study and thus they continued on the same diet and medical therapy throughout the study period. Central obesity is another high-risk factor for diabetes mellitus. The mean waist circumference also reduced from 101.33±10.60 (before yoga) to 99.63±10.53 (after yoga) but the difference was not statistically significant. Obesity is related to insulin resistance and the decrease in waist circumference and BMI of the subjects correlated with improvement in insulin resistance of the patients. Figure 1.

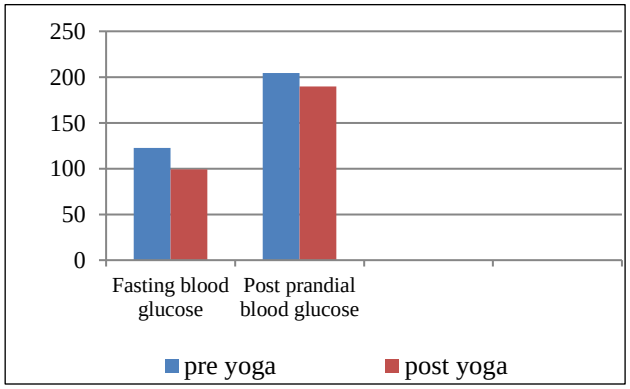

Figure 1: Comparison of fasting and post prandial blood glucose levels before and after 90 days of yoga.

This study is a part of our study in which we had seen the effects of yoga on blood glucose and serum insulin levels after yogic intervention. Authors found that the decrease in blood glucose and serum. Insulin levels were statistically significant.

DISCUSSION

The increasingly altered dietary habits and sedentary lifestyle has led to a shift in health problems from communicable to non-communicable diseases.[14] Of all the non-communicable diseases, diabetes and cardiovascular diseases lead the list.[15] Macroangiopathy in diabetes consists mainly of an accelerated form of atherosclerosis which leads to the narrowing of arterial walls throughout the body and affects the coronary, carotid and peripheral arteries, thereby increasing the risk of myocardial infarction, stroke and diabetic foot disease.[16-19] Risk of macroangiopathy is related to general risk factors for atherosclerosis such as age, hypertension, obesity, hypercholesterolaemia, dyslipidaemia and smoking.[20]

Yoga increases parasympathetic/vagal control of the heart and reduces sympathetic activation via decreased stress levels, as well as reduces systemic inflammation.[21] Better glycemic control and stable autonomic functions can be obtained in type 2 DM with yoga asanas and pranayama. A significant decrease in systolic and diastolic blood pressure along with decrease in fasting and postprandial blood glucose has been reported.[22] Studies have also reported significant improvement in both systolic and diastolic blood pressure.[23-24]

It was postulated that yoga brings about the decrease in blood pressure by decreasing the oxidative stress. Gordon et al, showed the effect of hath yoga on biochemical, oxidative stress indicators and oxidant status in patients with type 2 DM. Their studies suggested that yoga has therapeutic, preventive and protective effects on diabetes mellitus by decreasing oxidative stress and improving antioxidant status.[25] Significant reduction in FBG and PPBG levels in type 2DM patients has been shown. The possible mechanism may be direct rejuvenation of cells of pancreas due to abdominal stretching during yoga, which may increase utilization and metabolism of glucose in peripheral tissues, liver and adipose tissues through enzymatic process.[26] This leads to reduced cardiovascular risk. Our study also is in accordance with the previous studies done to show the significant reduction in FBG and PPBG.

A significant decrease in the body fat and increase in lean body mass in type 2 DM after yogic intervention has been reported. Yoga helps in the redistribution of fat by reduction of fat from waist, thus changing from central obesity to peripheral obesity due to change in insulin resistance.[26] Malhotra et al, showed reduction in weight and even distribution of fat in the body space in diabetic patients.[27] Chaya et al, also showed reduction in waist circumference, weight and BMI in type 2 diabetic patients.[28] This study also showed significant reduction in waist circumference, weight and BMI and improvement in insulin resistance after yogic intervention.

The limitation of this study was that it was an observational study, where no intervention could be done from our side. Further interventional studies and clinical trials may be undertaken to establish the beneficial effects of yoga in diabetes mellitus and other metabolic disorders.

CONCLUSION

The study showed a significant improvement in the metabolic profile in patients of diabetes mellitus with Yoga. So, it can be concluded that yoga can be used as an

adjunct to the conventional diet and drug therapy to modify hypertension in the management of type 2 DM.

ACKNOWLEDGEMENTS

Authors would like to thank all the subjects of the study and yoga sansthana and staff members of the department.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Kutty BM, Raju TR. New vistas in treating diabetes - Insight into a holistic approach. Indian J Med Res. 2010;131:606-7.
2. Kolb H, Mandrup-Poulsen T. An immune origin of type 2 diabetes. Diabetologia. 2005;48:1038-50.
3. Grundy S. Hypertriglyceridemia, insulin resistance, and the metabolic syndrome. Am J Cardiol. 1999;83:25F-9F.
4. Esler M, Rumantir M, Wiesner G, Kaye D, Hastings J, Lambert G. Sympathetic nervous system and insulin resistance: from obesity to diabetes. Am J Hypertens. 2001;14:304S-9S.
5. Perin PC, Maule S, Quadri R. Sympathetic nervous system, diabetes, and hypertension. Clin Exp Hypertens. 2001;23:45-55.
6. Gress TW, Nieto FJ, Shahar E, Wofford MR, Brancati FL. Hypertension and antihypertensive therapy as risk factors for type 2 diabetes mellitus. New Eng Med J Med. 2000;342(13):905-912.
7. Vazquez G, Duval S, Jacobs DR, Silventoinen K. Comparison of body mass index, waist circumference, and waist⁄hip ratio in predicting incident diabetes: a meta analysis. Epidemiological Reviews. 2007;29:115-28.
8. Packard RRS, Libby P. Inflammation in atherosclerosis: from vascular biology to biomarker discovery and risk prediction. Clinical Chemistry. 2008;54(1):24-38.
9. Zimmet P, Alberti KG, Shaw J. Global and societal implications of the diabetes epidemic. Nature. 2001;414:782-7.
10. Singh S, Malhotra V, Singh KP, Madhu SV, Tandon OP. Role of yoga in modifying certain cardiovascular functions in type 2 diabetic patients. J Assoc Phys India. 2004;52:203-6.
11. Bijlani RL, Vempati RP, Yadav RK, Ray RB, Gupta V, Sharma R, et al. A brief but comprehensive lifestyle education program based on yoga reduces risk factors for cardiovascular disease and diabetes mellitus. J Alt Complement Med. 2005;11:267-74.
12. Khatri D, Mathur KC, Gahlot S, Jain S, Agrawal RP. Effects of yoga and meditation on clinical and biochemical parameters of metabolic syndrome. Diabetes Res Clin Pract. 2007;78:9-10.
13. Jayasinghe SR. Yoga in cardiac health (a review). Euro J Cardiovas Preven Rehab. 2004;11:369-75.
14. Buse JB, Polonsky KS, Burant CF, Type 2 Diabetes mellitus. In: Kronrnberg HM, Mehmed S, Polonsky KS, Larsen PR, editors. Williams textbook of endocrinology, 11th ed. Elsevier Health Sciences, Inc.;2007:1329-90.
15. Brownlee M, Aiello LP, Mark Ec, Vinik AI, Nestrow RW, Boulton AJM, Complications of diabetes mellitus. In: Kronrnberg HM, Mehmed S, Polonsky KS, Larsen PR, editors. Williams textbook of endocrinology, 11th ed. Elsevier Health Sciences, Inc.;2007:1417-1502.
16. Duby JJ, Campbell RK, Setter SM, White JR, Rasmussen KA. Diabetic neuropathy: an intensive review. Am J Health Syst Pharm. 2004;61:160-73.
17. Goldberg RB. Cardiovascular disease in patients who have diabetes. Cardiol Clin. 2003;21(7):399-413.
18. Kikkawa R, Koya D, Haneda M. Progression of diabetic nephropathy. Am J Kidney Dis. 2003;41:S19-S21.
19. Porta M, Bandello F. Diabetic retinopathy: a clinical update. Diabetologia. 2002;45:1617-34.
20. Beckman JA, Creager MA, Libby P. Diabetes and atherosclerosis: epidemiology, pathophysiology, and management. JAMA. 2002;287:2570-81.
21. 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;18:491-519.
22. Singh S, Malhotra V, Singh KP, Madhu SV, Tandon OP. Role of yoga in modifying certain cardiovascular functions in type 2 diabetic patients. J Assoc Phys India. 2004;52:203-6.
23. Gore M. Yogic treatment for diabetes. Yoga Mimamsa. 1988;26:130-45.
24. Koertge J, Weidner G, Elliott-Eller M, Scherwitz L, Merritt-Worden TA, Marlin R, et al. Improvement in medical risk factors and quality of life in women and men with coronary artery disease in the Multicenter Lifestyle Demonstration Project. Am J Cardiol. 2003;91:1316-22.
25. Gordon LA, Morrison EY, McGrowder DA, Young R, Fraser YT, Zamora EM, et al. Effect of exercise therapy on lipid profile and oxidative stress indicators in patients with type 2 diabetes. BMC Complement Altern Med. 2008;13:8-21.
26. Sahay BK. Yoga and Diabetes. J Assoc Physicians India. 1986;34:645-8.
27. Malhotra V, Singh S, Sharma SB, Gupta P, Prasad A, Tandon OP, et al. The status of NIDDM patients after yoga asanas: Assessment of important parameters. J Clin Diag Res. 2010;4:2652-67.
28. Chaya MS, Ramakrishnan G, Shastry S, Kishore RP, Nagendra H, Nagarathna R, et al. Insulin sensitivity and cardiac autonomic function in young male practitioners of yoga. Natl Med J India. 2008 Jan 1;21(5):217.

Cite this article as: Shrivastava N, Maheswari BK, Rath D, Sarkar D. Effects of yoga in modifying blood pressure in patients of type 2 diabetes mellitus. Int J Res Med Sci 2018;6:3080-3.