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Original Research Article

TO STUDY THE EFFECT OF YOGA MEDITATION ON METABOLIC AND CARDIORESPITATORY RESPONSES IN TYPE – II DIABETES MELLITUS

Dhiraj Kumar[1], Binod Kumar Singh[1], Rakesh Kumar[1], Subodh Kumar Paswan[1], Sheela Kumari[2]

[1]PG Student, Department of Physiology, DMCH, Laheriasarai, Bihar, India
[2]Professor, Department of Physiology, Darbhanga Medical College, Laheriasarai, Bihar, India

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Corresponding Author:
Dr. Subodh Kumar Paswan,
Email: subodhkumar21@gmail.com

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Abstract

Background: The present study design aim is to find the effect of Yoga Meditation on metabolic and cardio-respiratory responses in patients of Type 2 Diabetes Mellitus. **Materials and Methods:** Present study was conducted in Departments of Physiology & Medicine, Darbhanga Medical College, Laheriasarai, Bihar. One Hundred Patients who were diagnosed and having TYPE-II Diabetes Mellitus are admitted from OPD department and In- Patient ward in General Medicine of Darbhanga Medical College, Laheriasarai, Bihar. Permission of the Ethical Committee was taken and consent of all participants was taken before entering the study. For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. P-value ≤ 0.05 was considered for statistically significant. **Result:** We found that both FBS (Fasting Blood Sugar) and PPBS (Post prandial Blood Sugar) were significantly higher in control compared to case. In our study Triglyceride, Total Cholesterol and LDL were less in case compared to control which were statistically significant. It was found that HDL was less in control compared to case which was statistically significant. The Mean heart rate was significantly higher in control compared to case. **Conclusion:** We have shown positive benefits of yoga in the management of diabetes with good impact on glycemic control, lipid profile and cardiovascular status. Further it can alleviate stress. Yoga can be considered as a good alternate for exercise therapy.

INTRODUCTION

Yoga is a group of physical, mental and spiritual practices or disciples which originated in ancient India. Yoga is a Sanskrit word derived from Sanskrit root ''yuj'' which means to connect, join or balance.[1]

Meditation is an element of yoga, which is concerned with mental relaxation and attentiveness.[2] Linkage between body and mind are well appreciated therefore it is quite likely that meditational science together can achieve the goal of optimum functioning of human body and mind. Meditation practices mainly change body functions through autonomic nervous system as autonomic nervous system links brain and body.[3]

Diabetes is one of the major causes of premature illness and death world wise.[4] According to WHO 346 million peoples suffer from diabetes world wise. Almost 4 million deaths per year across the globes are attributable to diabetes.[5] Although the prevalence of both Type 1 and Type 2 Diabetes mellitus is increasing world wise, prevalence of Type 2 diabetes mellitus is increasing rapidly, presumably because of increasing obesity, reduced physical activity level as country become more industrialized and ageing of population. Type 2 Diabetes is major cause of mortality, but several studies indicate that diabetes is likely under reported as a cause of death.[6] Type 2 Diabetes mellitus is now a leading cause of death and disability and significantly increase risk both for macro- vascular complications such as atherosclerosis, and micro- vascular complications such as retinitis, diabetic retinopathy, and renal disease.[7] DM 2 is strongly associated with elevated risk for other serious chronic conditions including depression and dementia. Cardiovascular disease is the primary cause of morbidity and mortality in those with DM 2, accounting for at least 65% of death in this population.[8]

Yoga practices have beneficial effect in management of patients of Type 2 Diabetes mellitus. Stress increases the risk and the risk and severity of diabetes by stimulating hypothalamic- epinephrine-pituitary axis by realizing increased level of cortisol, epinephrine, nor-epinephrine, growth hormone,

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glucagon etc. Increased level of inflammatory cytokines results in insulin resistance in patients of Type 2 DM.[9] Chronic psychological stress can result in insulin resistance, hypertension and risks of cardiovascular events. Yoga effectively reduces stress thereby helping diabetic control.[10]

The present study design aim is to find the effect of Yoga Meditation on metabolic and cardio-respiratory responses in patients of Type 2 Diabetes Mellitus.

Aims and Objectives

1. To study metabolic and cardio-respiratory abnormalities in Type-II diabetes mellitus.
2. To find out correlation between Yoga Mediation and metabolic and cardio-respiratory responses in Type-II diabetes mellitus.
3. To compare result between case and control.

MATERIALS AND METHODS

Present study was conducted in Departments of Physiology & Medicine, Darbhanga Medical College, Laheriasarai, Bihar. One Hundred Patients who were diagnosed and having TYPE-II Diabetes Mellitus are admitted from OPD department and In-Patient ward in General Medicine of Darbhanga Medical College, Laheriasarai, Bihar. Permission of the Ethical Committee was taken and consent of all participants was taken before entering the study.

Statistical Analysis

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. P-value ≤ 0.05 was considered for statistically significant.

Inclusion Criteria

All patients who have diagnosed on TYPE-II Diabetes Mellitus

Exclusion Criteria

The study excluded the patients having hypertension, pregnancy, previous known respiratory diseases, cardiac diseases and metabolic disease.

- All diabetic patients (100) were divided into two groups.
  1. Case Group (50) – Performing yoga meditation
  2. Control Group (50) – Not performing yoga meditation.

RESULTS

Table 1: Distribution of mean Age: Group

		Number	Mean	SD	Minimum	Maximum	Median	p-value
Age	Control	50	51.2000	7.6024	38.0000	68.0000	50.5000	0.5649
	Case	50	52.0800	7.6341	40.0000	68.0000	51.0000	

In Control, the mean Age (mean± s.d.) of patients was 51.2000 ± 7.6024.
In Case Group, the mean Age (mean± s.d.) of patients was 52.0800 ± 7.6341.
Difference of mean Age with Group was not statistically significant (p=0.5649).

Table 2: Distribution of mean FBS: Groups

		Number	Mean	SD	Minimum	Maximum	Median	p-value
FBS	Control	50	111.0000	16.1485	84.0000	142.0000	109.5000	<0.0001
	Case	50	97.5200	10.8932	80.0000	123.0000	95.0000	

In Control, the mean FBS (mean± s.d.) of patients was 111.0000 ± 16.1485.
In Case Group, the mean FBS (mean± s.d.) of patients was 97.5200 ± 10.8932.
Difference of mean FBS with Group was statistically significant (p<0.0001).

Table 3: Distribution of mean PPBS: Group

		Number	Mean	SD	Minimum	Maximum	Median	p-value
PPBS	Control	50	132.2400	20.8342	101.0000	166.0000	122.5000	0.0021
	Case	50	121.0800	13.8060	101.0000	160.0000	118.5000	

In Control, the mean PPBS (mean± s.d.) of patients were 132.2400 ± 20.8342.
In Case Group, the mean PPBS (mean± s.d.) of patients were 121.0800 ± 13.8060.
Difference of mean PPBS with Group was statistically significant (p=0.0021).

Table 4: Distribution of mean Heart Rate: Group

		Number	Mean	SD	Minimum	Maximum	Median	p-value
Heart Rate	Control	50	98.9200	11.7973	70.0000	120.0000	102.0000	<0.0001
	Case	50	81.7800	8.4571	70.0000	102.0000	79.5000	

In Control, the mean Heart Rate (mean± s.d.) of patients was 98.9200 ± 11.7973.
In Case Group, the mean Heart Rate (mean± s.d.) of patients was 81.7800 ± 8.4571.
Difference of mean Heart Rate with Group was statistically significant (p<0.0001).

Table 5: Distribution of mean SBP: Group

		Number	Mean	SD	Minimum	Maximum	Median	p-value
SBP	Control	50	151.9200	14.0725	112.0000	170.0000	156.0000	<0.0001
	Case	50	117.9200	5.9241	110.0000	128.0000	117.0000	

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In Control, the mean SBP (mean± s.d.) of patients was 151.9200 ± 14.0725.
In Case Group, the mean SBP (mean± s.d.) of patients was 117.9200 ± 5.9241.
Difference of mean SBP with Group was statistically significant (p<0.0001).

Table 6: Distribution of mean DBP: Group

		Number	Mean	SD	Minimum	Maximum	Median	p-value
DBP	Control	50	91.6800	10.6550	70.0000	106.0000	96.0000	<0.0001
	Case	50	76.7600	5.1093	70.0000	88.0000	74.0000	

In Control, the mean DBP (mean± s.d.) of patients was 91.6800 ± 10.6550.
In Case Group, the mean DBP (mean± s.d.) of patients was 76.7600 ± 5.1093.
Difference of mean DBP with Group was statistically significant (p<0.0001).

We found that both FBS (Fasting Blood Sugar) and PPBS (Post prandial Blood Sugar) were significantly higher in control compared to case. It was found that urea was more in control compared to case which was statistically significant. In our study Triglyceride, Total Cholesterol and LDL were less in case compared to control which were statistically significant. It was found that HDL was less in control compared to case which was statistically significant. The Mean heart rate was significantly higher in control compared to case.

DISCUSSION

Our study showed that, in Control, the mean Age (mean± s.d.) of patients was 51.2000 ± 7.6024. In Case, the mean Age (mean± s.d.) of patients was 52.0800 ± 7.6341. Difference of mean Age with Group was not statistically significant (p=0.5649).[11] It was found that, in Control, 5(10.0%) patients were 31-40 years old, 20(40.0%) patients were 41-50 years old, 21(42.0%) patients were 51-60 years old and 4(8.0%) patients were 61-70 years old. In Case, 2(4.0%) patients were 31-40 years old, 23(46.0%) patients were 41-50 years old, 18(36.0%) patients were 51-60 years old and 7(14.0%) patients were 61-70 years old.[12] Association of Age in years vs group was not statistically significant (p=0.4674). In Control, 17(34.0%) patients were Female and 33(66.0%) patients were Male. In Case, 18(36.0%) patients were Female and 32(64.0%) patients were Male. Association of Sex vs group was not statistically significant (p=0.8339).[11]

Ramamoorthi R et al,[12] (2019) showed that yoga intervention improved fasting blood glucose (FBG) [Standard Mean Difference (SMD -0.064 mg/dL (95% CI -0.201 to 0.074)]; low density lipoprotein (LDL) [SMD-0.090 mg/dL (95% CI -0.270 to 0.090)]; triglycerides [SMD -0.148 mg/dL (95% CI -0.285 to -0.012)]; total cholesterol [SMD -0.058 mg/dL (95% CI -0.220 to 0.104)] and systolic blood pressure [SMD -0.058 mm Hg (95% CI -0.168 to 0.053)]. These results suggest that yoga intervention may be considered as a comprehensive and alternative approach to preventing T2DM. Further adequately powered, well designed RCTs are needed to support their findings and investigate the long-term effects of yoga in T2DM patients.

Raveendran AV et al,[13] (2018) found that yoga practice in daily life helps to attain glycaemic control and reduces the risk of complications in people with diabetes. In this review, they briefly describe the role of various yoga practices in the management of diabetes based on evidence from various clinical studies.

Phatak MS et al,[14] (2017) found that Blood glucose level and glycated haemoglobin levels were significantly lower in yoga practitioners. Lipid profile showed significant reduction in total cholesterol and serum triglycerides. Thus, a better glycaemic control is achieved with regular practice of Raja yoga meditation which helps in maintaining optimal level of autonomic equilibrium at rest as well as during exposure to stress.

Singh A et al,[15] (2017) found that there was a significant decrease in fasting ($p < 0.001$) and post-prandial blood sugar levels ($p < 0.001$) along with a significant reduction in medication and symptom scores after 15 days of RIYP compared to baseline. The present study indicates that 2 weeks of a yoga-based residential program improves blood glucose levels, blood pressure, and medication score in patients with T2DM.

Ray R et al,[16] (2019) observed that FBS, total cholesterol, triglyceride, and low-density lipoprotein level in serum were significantly lower in participants practicing yoga, and high-density lipoprotein value was significantly raised.

Thind H et al,[17] (2017) found that yoga participants were successful in improving their HbA1c ($d + = 0.36$, 95% CI = 0.16, 0.56; $k = 16$), FBG ($d+ = 0.58$, 95% CI = 0.40, 0.76; $k = 20$), and PPBG ($d + = 0.40$, 95% CI = 0.23, 0.56; $k = 14$). Yoga was also associated with significant improvements in lipid profile, blood pressure, body mass index, and waist/hip ratio and cortisol levels. Overall, studies satisfied an average of 41% of the methodological quality (MQ) criteria; MQ score was not associated with any outcome (Ps > 0.05). Yoga improved glycemic outcomes and other risk factors for complications in adults with T2DM relative to a control condition. Additional studies with longer follow-ups are needed to determine the long-term efficacy of yoga for adults with T2DM.

It was found that, in Control, the mean PPBS (mean± s.d.) of patients were 132.2400 ± 20.8342. In Case, the mean PPBS (mean± s.d.) of patients were 121.0800 ± 13.8060. Difference of mean PPBS with Group was statistically significant (p=0.0021). In Control, the mean Urea (mean± s.d.) of patients was

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45.7000 ± 8.4594. In Case, the mean Urea (mean± s.d.) of patients was 42.1800 ± 3.1732. Difference of mean Urea with Group was statistically significant (p=0.0070). In Control, the mean Creatine (mean± s.d.) of patients was .8840 ± .1517. In Case, the mean Creatine (mean± s.d.) of patients was .8980 ± .1571. Difference of mean Creatine with Group was not statistically significant (p=0.6513).

Our study showed that, in Control, the mean TG (mean± s.d.) of patients was 162.0000 ± 18.3826. In Case, the mean TG (mean± s.d.) of patients was 134.8200 ± 11.7607. Difference of mean TG with Group was statistically significant (p<0.0001). In Control, the mean TC (mean± s.d.) of patients was 225.6600 ± 37.5997. In Case, the mean TC (mean± s.d.) of patients was 167.1600 ± 28.1123. Difference of mean TC with Group was statistically significant (p<0.0001).

Arumugam G et al,[18] (2020) showed that blood pressure (BP) < 140/90 mmHg, stringent BP (<130/80 mmHg) and lipid, LDL-C < 100 mg/dl [risk factor for atherosclerotic cardiovascular disease]. Logistic regression was used to compare between the two treatment groups. Compared to standard of care, adjunct yoga-treatment was found to significantly facilitate the attainment of ADA composite score by 8-fold; A1C, ~2-fold; LDL-C, ~2-fold; BP < 140/90 mmHg and <130/80 mmHg by ~8-and ~6-fold respectively. This study provides the first evidence for significant efficacy of adjunct yoga-treatment for the attainment of favourable treatment goals for T2D in rural Indian settings.

We also found that, in Control, the mean HDL (mean± s.d.) of patients was 41.5600 ± 8.8943. In Case, the mean HDL (mean± s.d.) of patients was 55.9200 ± 9.0730. Difference of mean HDL with Group was statistically significant (p<0.0001). In Control, the mean LDL (mean± s.d.) of patients was 103.5000 ± 21.6430. In Case, the mean LDL (mean± s.d.) of patients was 81.0600 ± 7.8126. Difference of mean LDL with Group was statistically significant (p<0.0001). In Control, the mean Heart Rate (mean± s.d.) of patients was 98.9200 ± 11.7973. In Case, the mean Heart Rate (mean± s.d.) of patients was 81.7800 ± 8.4571. Difference of mean Heart Rate with Group was statistically significant (p<0.0001).

Cramer H et al,[19] (2014) showed that yoga improved systolic (mean difference (MD) = −5.85 mm Hg; 95% confidence interval (CI) = −8.81, −2.89) and diastolic blood pressure (MD = −4.12 mm Hg; 95%CI = −6.55, −1.69), heart rate (MD = −6.59 bpm; 95%CI = −12.89, −0.28), respiratory rate (MD = −0.93 breaths/min; 95%CI = −1.70, −0.15), waist circumference (MD = −1.95 cm; 95%CI = −3.01, −0.89), waist/hip ratio (MD = −0.02; 95%CI = −0.03, −0.00), total cholesterol (MD = −13.09 mg/ dl; 95%CI = −19.60, −6.59), HDL (MD = 2.94 mg/dl; 95%CI = 0.57, 5.31), VLDL (MD = −5.70 mg/dl; 95%CI = −7.36, −4.03), triglycerides (MD = −20.97 mg/dl; 95%CI = −28.61, −13.32), HbA1c (MD = −0.45%; 95%CI = −0.87, −0.02), and insulin resistance (MD = −0.19; 95%CI = −0.30, −0.08). Relative to exercise, yoga improved HDL (MD = 3.70 mg/dl; 95%CI = 1.14, 6.26). This meta-analysis revealed evidence for clinically important effects of yoga on most biological cardiovascular disease risk factors. Despite methodological drawbacks of the included studies, yoga can be considered as an ancillary intervention for the general population and for patients with increased risk of cardiovascular disease

Cui J et al,[20] (2017) showed that the pooled weighted mean differences were −23.72 mg/dL (95% CI −37.78 to −9.65; P = 0.001; I2 = 82%) for fasting blood glucose and −0.47% (95% CI −0.87 to −0.07; P = 0.02; I2 = 82%) for haemoglobin A1c. The weighted mean differences were −17.38 mg/dL (95% CI −27.88 to −6.89; P = 0.001; I2 = 0%) for postprandial blood glucose, −18.50 mg/dL (95% CI −29.88 to −7.11; P = 0.001; I2 = 75%) for total cholesterol, 4.30 mg/dL (95% CI 3.25 to 5.36; P < 0.00001; I2 = 10%) for high-density lipoprotein cholesterol, −12.95 mg/dL (95% CI −18.84 to −7.06; P < 0.0001; I2 = 37%) for low-density lipoprotein cholesterol and −12.57 mg/dL (95% CI −29.91 to 4.76; P = 0.16; I2 = 48%) for triglycerides. The available evidence suggests that yoga benefits adult patients with type 2 diabetes mellitus. However, considering the limited methodology and the potential heterogeneity, further studies are necessary to support their findings and investigate the long-term effects of yoga in type 2 diabetes mellitus patients.

CONCLUSION

Yoga can help the person feel better, both improving the physical fitness and elevating the mood. We have shown positive benefits of yoga in the management of diabetes with good impact on glycemic control, lipid profile and cardiovascular status. Further it can alleviate stress. Yoga can be considered as a good alternate for exercise therapy.

Perceived stress adversely affects cardiovascular and respiratory profile of healthy young adult males, and regular practice of yoga may decrease perceived stress levels and help in modulating cardio respiratory profile.

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