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Effectiveness of Yoga Therapy and Chakra Meditation on Biochemical Variables in Patients with Type-2 Diabetes Mellitus

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ABSTRACT:

Background: Type 2 diabetes mellitus (T2DM) is a common metabolic disease that is typified by insulin resistance and persistent hyperglycemia. Yoga therapy, which combines physical postures, breathing exercises, and meditation, has shown promising results in improving biochemical variables such as fasting blood glucose, HbA1c and other diabetics related issues.

Objectives: This study was designed to investigate the therapeutic effect of yoga practices on selected biochemical variables among middle aged men.

Materials and Methods: To achieve the purpose of the study (N=36) thirty-six middle aged men were selected from Manavalakkalai SKY yoga centre in Paramakudi, Ramanathapuram district, Tamil Nadu, India as subjects. The age of the subjects ranged from 35 to 45 years. The selected subjects were divided into three groups (n=12). Experimental Group-1 underwent asana, pranayama and relaxation techniques. Experimental Group II underwent asana, pranayama, relaxation techniques and chakra meditation. Group-III acted as control group who did not undergo any training program other than their routine. The biochemical variables such as fasting blood glucose, post prandial blood glucose and HbA1c were selected as dependent variables and they were assessed by Glucose oxidase peroxidase (Trinder,1969) method and (Jeppsson, J. O., et al. (2002).**)** Method. The subjects were concerned with their yoga practices for a period of three months, six days per week. The collected data from three groups prior to and immediately after the training programme on selected criterion variables were statistically analysed with analysis of covariance. The level of confidence was fixed at 0.05 for all the cases to test the hypothesis. Results: The result of the study reveals that the yoga practices training group-I &II achieved significant improvement on selected biochemical variables such as fasting blood glucose, post prandial blood glucose and HbA1c among middle aged men type-2 diabetic patients.

Key Words: Asana, Pranayama, Relaxation, Chakra Meditation, Diabetes Mellitus, Fasting Blood Glucose, Post Prandial Blood Glucose and HbA1c.

1. INTRODUCTION

Yoga therapy is very effective in the 21st century for various chronic psychosomatic diseases. Type 2 diabetes has caused a huge change in the state of human mobility not only in India but also globally. Although there are various causes for type 2 diabetes, the most important causes are lifestyle, especially inactivity, stress-related work and fast food. To get rid of these diseases, if you make changes in lifestyle and behavior, you can protect yourself from the severity of this type of disease. Although there are various types of exercise methods for this, yoga exercises are especially effective. This is because the asanas, pranayama exercises, meditation and simple physical relaxation exercises mentioned in yoga exercises can reduce

the severity of psychosomatic diseases and protect yourself from them by affecting not only the physical level but also the pranic layer (Pranamaya Kosha) and the mind layer (Manomaya Kosha).

Diabetes mellitus is a chronic, hormonal, and metabolic disease that is one of the most puzzling clinical research mysteries. According to Abebe et al. (2014), it ranks among the top five causes of death in the majority of developed nations. It has become an epidemic and has placed a tremendous strain on healthcare systems, and it is predicted to get worse. Numerous pieces of evidence indicate that it may become epidemic-level, especially in developing and recently industrialized nations. The International Diabetes Federation (IDF) estimates that 62 million people died from diabetes worldwide in 2023. Regular yoga practice has been linked to improved glucose regulation. Research has shown that participants in yoga therapy and chakra meditation interventions experience significant decreases in their HbA1c, PPBG, FBS levels and other issues related to type-2DM. Increased glucose metabolism and insulin sensitivity are suggested by these improvements.

2. AIM AND OBJECTIVES

To study the effectiveness of yoga therapy and chakra meditation on fasting blood glucose (FBG), post prandial blood glucose (PPBG) and HbA1c in Type-2 Diabetes Mellitus.

2.1. OBJECTIVES

1. To estimate the levels of blood glucose and post prandial blood glucose in type-2 diabetes mellitus patients with and without yoga therapy and chakra meditation.
2. To measure the HbA1c in Type-2 Diabetes Mellitus with and without yoga therapy and chakra meditation.

3. MATERIALS AND METHODS

3.1. Study Design

This was interventional study.

3.2. Selection of Participants

To achieve the purpose of the study, thirty sex middle aged men have been randomly selected from Paramakudi, Ramanathapuram District, Tamilnadu State, India.

3.3. Selection of Variables

The present study mainly focuses on yoga Therapy with chakra meditation and its influences on selected biochemical variables in patients with type-2 diabetes mellitus. The investigator has selected the following variables as criterion measures.

1) Fasting blood glucose levels
2) Postprandial blood glucose levels
3) HbA1c levels

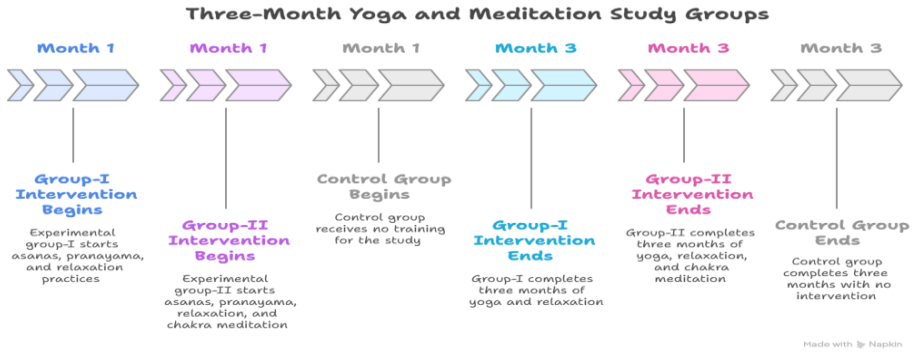
3.4. Interventions

The study subjects were divided into2 groups.

Group-1: Experimental group-I was treated as asanas, pranayama, relaxation practices. (Three Month)

Group-II: Experimental group-II was treated as asanas, pranayama, relaxation with chakra meditation practices. (Three Month)

Group-III: Control group was not given any training. (Three Month)



3.5. Inclusion Criteria

To achieve the purpose of the study, seventy-five men in the age-group of 35- 45 years to be selected as subjects. Randomly divided into three groups as of each group contains thirty sex subjects. The experimental group treatment to be administered for period of three months, five days per week, one session per day and each session lasted 60 minutes in the evening session.

3.6. Exclusion Criteria

Diabetic patients with heart problem to not be considered. Diabetic patients with any pathological conditions to not be included. Clinical Surgery patients to not be considered. A history of any pancreatic infectious patients to not be considered and psychological problematic persons to not be considered.

3.7. Bio-chemical Analysis

The investigator selected the following standardized test for testing the selected variables.

TABLE-1

SELECTION OF THE BIOCHEMICAL TEST

S.No	Variables	Biochemical Analysis
1	Fasting Glucose	Levels to be estimated by Glucose oxidase peroxidase (Trinder,1969) method
2	Post prandial Blood glucose (PPBG)	
3	HbA1c	By Jeppsson, J. O., et al. (2002) Method.

3.8. Therapeutic Schedule of Experimental Groups (I & II)

TABLE-2

3.9. Statistical Technique

S.No	Yoga Practices	1 to 4 Weeks			5 to 8 Weeks			9 to 12 Weeks		
		Repetitions	Duration	Rest	Repetitions	Duration	Rest	Repetitions	Duration	Rest
1	**Prayer (OM Chanting)**	3 Times (One Minute)								
2	**Breathing Practices**	Standing, Sitting and Supine Position								
3	**Sukhma Vvayama & Loosening-exercise**	5 Minutes								
4	**Asanas**	**30 Minutes**								
	Ardhakati Chakrasan	4	30 Sec	25 Sec	3	45 Sec	20 Sec	2	60 Sec	20 Sec
	Padahastasana	4	30 Sec	25 Sec	3	45 Sec	20 Sec	2	60 Sec	20 Sec
	Vakrasan	4	30 Sec	25 Sec	3	45 Sec	20 Sec	2	60 Sec	20 Sec
	Matsyendrasan	4	30 Sec	25 Sec	3	45 Sec	20 Sec	2	60 Sec	20 Sec
	Bhujangasana	4	30 Sec	25 Sec	3	45 Sec	20 Sec	2	60 Sec	20 Sec
	Dhanurasan	4	30 Sec	25 Sec	3	45 Sec	20 Sec	2	60 Sec	20 Sec
	Viparita Karani (Leg up pose)	4	30 Sec	25 Sec	3	45 Sec	20 Sec	2	60 Sec	20 Sec
	Ardha Matsyasana (Modified Pose)	4	30 Sec	25 Sec	3	45 Sec	20 Sec	2	60 Sec	20 Sec
5	Relaxation Technique	Deep Relaxation Technique (D.R.T) (5 minutes)								
6	**Breathing Practices**	Standing, Sitting and Supine Position								
7	**Pranayama**	**8 Minutes**								
	Sectional Breathing	3 Minutes								
	Nadisodhana	3 Minutes								
	Brammari	2 Minutes								
In Addition (Experimental Group-2 Only)										
8	**Meditation** (Chakra Meditation)	**20 Minutes**								

The collected data were analyzed statistically through analysis of covariance (ANCOVA) and to find out the significance difference between experimental groups and control group., if any between the groups. A p value of < 0.05 as significant and p value of < 0.01 was considered highly significant.

4. DISCUSSION ON RESULTS

4.1. Result on Fasting Blood Glucose Level (FBGL)

Table 3.1 to 3.3. shows that the substantial F-value of 49.18 and the highly significant p-value of less than 0.0001 indicate a statistically significant variation in fasting glucose levels across the three groups, even after accounting for covariates such as pre-test scores. Among the groups, Experimental Group II had the lowest adjusted mean glucose level at 151.54 mg/dl, followed by Group I at 154.18 mg/dl, while the Control Group had the highest at 176.03 mg/dl. The assumption of homogeneity of regression slopes is met (p = 0.765), supporting the application of ANCOVA and confirming the validity of the adjusted means.

TABLE-3.1

Dependent Variable			
Sample			
Experimental Group-1	**Experimental Group-2**	**Control Group**	**Total**
n			
12	12	**12**	36
Observed Means			
153.4167	153.5833	174.75	160.5833
Adjusted Means			
154.1755	151.5404	176.0341	160.5833
Aggregate Correlation within Samples: CV vs DV			
r = 0.8		**r^2 = 0.65**	

TABLE-3.2

ANCOVA SUMMARY

Source	SS	df	MS	F	P.
Adjusted Means	4277.23	2	2138.61	49.18	<.0001
Adjusted Error	1391.42	32	43.48		
Adjusted Total	5668.65	34			

TABLE-3.3

Test for homogeneity of regressions

Source	SS	df	MS	F	P.
Between regressions	24.98	2	12.49	0.27	0.765215
Remainder	1366.44	30	45.55		
Adjusted error	1391.42	32			

Table 3.1 to 3.3. shows that the examination of adjusted means highlighted significant variations among the groups. Group I had an adjusted mean of 154.18 mg/dl, Group II showed 151.54 mg/dl, whereas the Control group had a higher mean of 176.03 mg/dl. The ANCOVA produced a significant F-value of 49.18 for the adjusted means, with a p-value of less than 0.0001, indicating statistically significant differences between the groups after accounting for the covariate. The correlation coefficient (r) between the covariate and the dependent variable was 0.8, indicating a strong positive association. Furthermore, the coefficient of determination (r^2) was 0.65, suggesting that 65% of the variance in the dependent variable could be attributed to the covariate. The test for homogeneity of regression slopes revealed no significant interaction between the covariate and the treatment ($F = 0.27$, $p = 0.765$), confirming the assumption for ANCOVA and indicating that the regression slopes were consistent across groups.

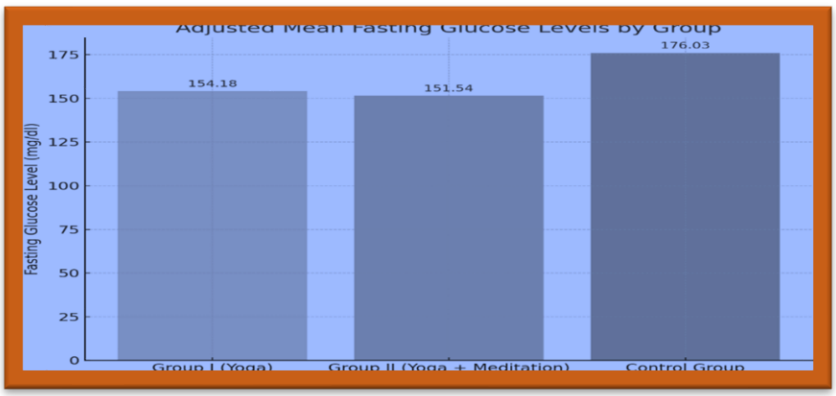


Fig.1: Bar diagram of fasting glucose in T2DM patients. (FBGL)

4.2. Result on Post Prandial Blood Glucose (PPBG) Level

Table 4.1 to 4.3. shows that the ANCOVA test revealed a highly significant effect of the interventions on postprandial blood glucose levels, with $F = 304.06$ and $p < 0.0001$. Adjusted mean PPBG values were lowest in Group I (234.44 mg/dl), followed closely by Group II (240.81 mg/dl). The Control Group remained high at 267.49 mg/dl. The coefficient of determination ($r^2 = 0.89$) indicates that 89% of the variation in PPBG was explained by the intervention and the covariate. The homogeneity of regression slopes test showed no significant

difference (p = 0.315), confirming that ANCOVA assumptions were met and the adjusted means are valid.

TABLE-4.1

Dependent Variable			
Sample			
Experimental Group-1	Experimental Group-2	Control Group	Total
n			
12	12	**12**	36
Observed Means			
232.75	243.4167	266.5833	247.5833
Adjusted Means			
234.4415	240.8144	267.4941	247.5833
Aggregate Correlation within Samples: CV vs DV			
r = 0.94		**r^2 = 0.89**	

TABLE-4.2

ANCOVA SUMMARY

Source	SS	df	MS	F	P.
Adjusted Means	7371.58	2	3685.79	304.06	<.0001
Adjusted Error	387.9	32	12.12		
Adjusted Total	7759.48	34			

TABLE-4.3

Test for homogeneity of regressions

Source	SS	df	MS	F	P.
Between regressions	28.63	2	14.31	1.2	0.315242
Remainder	359.27	30	11.98		
Adjusted error	387.9	32			

Table 4.1 to 4.3. shows that the ANCOVA was performed to assess the impact of interventions on postprandial blood glucose (PPBG) levels, taking covariates into account. The

adjusted mean PPBG levels were 234.44 mg/dl for Experimental Group I (Yoga), 240.81 mg/dl for Experimental Group II (Yoga + Meditation), and 267.49 mg/dl for the Control group. The observed means were similar, with values of 232.75 mg/dl, 243.42 mg/dl, and 266.58 mg/dl, respectively. The analysis yielded a highly significant F-value of 304.06 ($p < 0.0001$), indicating notable differences between groups after accounting for the covariate. The correlation between the covariate and the dependent variable was very strong ($r = 0.94$), and the coefficient of determination ($r^2 = 0.89$) indicated that 89% of the variance in PPBG levels was explained by the covariate. Additionally, the test for homogeneity of regression slopes showed no significant interaction between the covariate and the treatment groups ($F = 1.2$, $p = 0.315$), confirming that the assumption of parallel regression slopes was satisfied and the use of ANCOVA was justified.

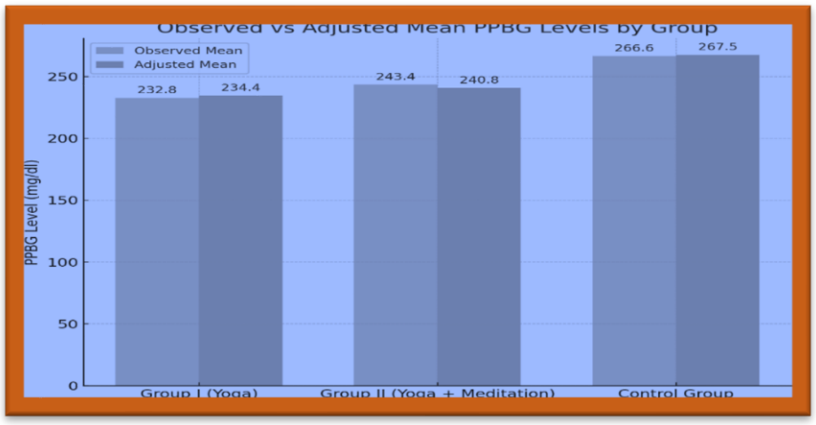


Fig.2: Bar diagram of post prandial blood glucose (PPBG) in T2DM patients.

4.3. Result on HbA1c Level

Table 5.1 to 5.3. shows that the ANCOVA test shows a statistically significant difference in post-intervention HbA1c levels among the three groups after adjusting for pre-test scores ($p < 0.0001$). The experimental groups showed lower adjusted mean HbA1c levels compared to the control group. Group II (Yoga + Chakra Meditation) had the lowest adjusted mean (7.4458%), suggesting the highest improvement. The test for homogeneity of regression indicates that the assumption of equal slopes is satisfied, validating the ANCOVA result.

TABLE-5.1

Dependent Variable			
Sample			
Experimental Group-1	Experimental Group-2	Control Group	Total
n			
12	12	**12**	36
Observed Means			

7.675	7.4167	8.7	7.9306
Adjusted Means			
7.7987	7.4458	8.5471	7.9306
Aggregate Correlation within Samples: CV vs DV			
r = 0.88		**r^2 = 0.77**	

TABLE-5.2

ANCOVA SUMMARY

Source	SS	df	MS	F	P.
Adjusted Means	7.09	2	3.54	97.28	<.0001
Adjusted Error	1.17	32	0.04		
Adjusted Total	8.25	34			

TABLE-5.3

Test for homogeneity of regressions

Source	SS	df	MS	F	P.
Between regressions	0.04	2	0.02	0.53	0.594015
Remainder	1.13	30	0.04		
Adjusted error	1.17	32			

Table 5.1 to 5.3. shows that the ANCOVA was conducted to assess the effect of yoga therapy and chakra meditation on HbA1c levels in patients with Type-2 Diabetes Mellitus, adjusting for baseline differences. The observed mean HbA1c percentages were 7.675% for Experimental Group I (Yoga), 7.4167% for Experimental Group II (Yoga + Chakra Meditation), and 8.7% for the Control Group. After adjusting for covariates, the mean values were 7.7987% for Group I, 7.4458% for Group II, and 8.5471% for the Control Group. The ANCOVA yielded a highly significant F-value of 97.28 (df = 2,32) with a p-value of less than 0.0001, indicating that the interventions had a statistically significant effect on HbA1c levels. Additionally, the homogeneity of regression slopes test showed no significant interaction between the covariate and treatment groups (F = 0.53, p = 0.594), confirming that the assumption of equal regression slopes was met and validating the ANCOVA results.

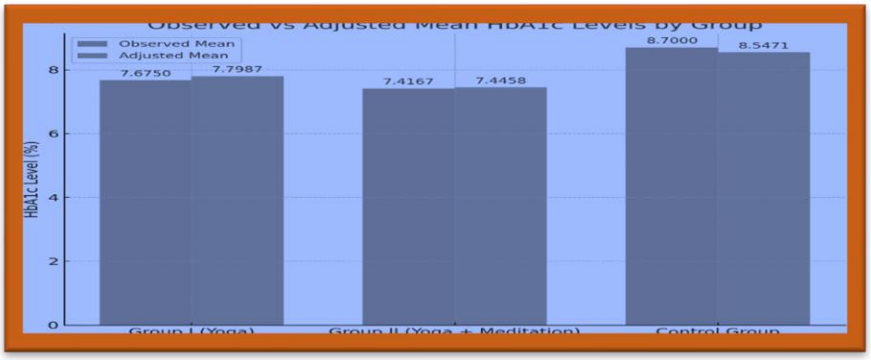


Fig.3: Bar diagram of HbA1c in T2DM patients.

5. CONCLUSION

1. Yoga therapy (comprising asanas, pranayama, and relaxation) significantly reduces fasting glucose levels in Type-2 diabetic patients. Addition of Chakra Meditation (Experimental Group II) further enhances this effect, leading to the greatest reduction in glucose levels. No significant change was observed in the control group, confirming the effectiveness of the yoga-based interventions. The results strongly support the integration of yoga and meditative practices as complementary therapeutic modalities for managing Type-2 diabetes.
2. Both yoga therapy alone and yoga with chakra meditation significantly reduced postprandial blood glucose levels in men with Type-2 Diabetes. Yoga therapy alone (Group I) showed a slightly greater reduction in PPBG compared to the group with added chakra meditation (Group II). The control group showed no significant change, affirming the effectiveness of the interventions. These results support the integration of structured yoga-based practices as an effective complementary therapy for managing blood sugar levels in diabetic patients, particularly after meals.
3. The combination of yoga therapy (asanas, pranayama, and relaxation) and chakra meditation is more effective in reducing HbA1c levels among type-2 diabetic patients than yoga therapy alone or no intervention. Regular practice over three months resulted in significant biochemical improvement, indicating that such holistic interventions may serve as valuable complementary treatments for glycemic control in type-2 diabetes management.

6. ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional. (MMCH & RI IEC APPROVAL Reference number: MMCH & RI IEC/ PhD/ 26/ JAN/ 23). This article does not contain any studies with animals performed by any of the authors.

7. INFORMED CONSENT

Informed consent was obtained from all individual participants included in the study.

8. CONFLICT OF INTEREST

We (Authors) declare that we have no conflict of interest.

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