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Effectiveness Of Yoga Therapy And Meditation On Hba1c Levels In Relation To Demographic Data In Type-2 Diabetic Middle-Aged Men

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ABSTRACT

Background:This study investigated the impact of yoga therapy and meditation on glycated hemoglobin (HbA1c) levels in middle-aged men with Type-2 Diabetes Mellitus (T2DM) and analyzed the influence of demographic variables such as age, body mass index (BMI), duration of diabetes, socioeconomic status, and educational background. Objectives: To evaluate the effectiveness of yoga therapy and meditation in reducing HbA1c levels and to examine how demographic variables influence these outcomes. Materials and Methods: To achieve the purpose of the study (N=40) forty middle aged men were selected from Manavalakkalai SKY yoga centre in Paramakudi, Ramanathapuram district, Tamil Nadu, India as subjects. The selected subject was divided in to two groups: an intervention group undergoing yoga and meditation, and a control group who did not undergo any training program other than their routine. A 12-week intervention involving structured yoga therapy and chakra meditation sessions was conducted on a sample of 20 men aged 35–45 years. Results: Significant reductions in HbA1c levels were observed in the intervention group compared to the control group. Demographic factors such as age, BMI, duration of diabetes, education, occupation, and income level significantly influence HbA1c levels in individuals with Type-2 Diabetes Mellitus. The results lend credence to the inclusion of yoga therapy and meditation in routine diabetes care regimens.

Keywords: *Type-2 Diabetes, HbA1c, Yoga Therapy, Meditation, Demographic Data, Middle-Aged Men.*

1. INTRODUCTION

In the context of Yoga therapy, disease is fundamentally understood as an imbalance in the equilibrium of three key aspects of existence: the Panchakoshas, Panchabhutas, and Pancha Pranas. The Panchakoshas represent the working planes of human energy, comprising five subtle layers—namely the physical (Annamaya), vital (Pranamaya), mental (Manomaya), intellectual (Vijnanamaya), and bliss (Anandamaya) sheaths. These sheaths together form the multidimensional framework of human existence. The Panchabhutas, on the other hand, refer to the five elemental building blocks of nature—Earth, Water, Fire, Air, and Space—which constitute the material composition of the body. Complementing these are the Pancha Pranas, or five vital life energies: Prana, Apana, Vyana, Udana, and Samana, which govern and sustain physiological processes and link the energy and mass dimensions of the body.

According to Patanjali's Yoga Sutras, a truly healthy body is one that manifests three essential qualities: Prakasa (glow or illumination), reflecting inner vitality and clarity; Kriya (action), denoting the capacity for dynamic function and purposeful movement; and Sthiti (stability), signifying both structural and energetic balance. When the equilibrium among the koshas, elements, and pranas is maintained, these three qualities

emerge naturally, signifying a state of physical health, mental clarity, and spiritual harmony. (Patanjali Yoga Sutra)

Type-2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder with high global prevalence, particularly affecting middle-aged men due to sedentary lifestyles, poor diet, and stress. Glycated hemoglobin (HbA1c) serves as a reliable biomarker for assessing long-term glycemic control. Yoga therapy and meditation have gained attention as complementary approaches for managing T2DM by improving insulin sensitivity, reducing stress, and promoting overall well-being.

2. STUDY OBJECTIVES

1. To evaluate the effectiveness of yoga therapy and meditation in reducing HbA1c levels.
2. To assess the demographic data: age, BMI, duration of diabetes, education, occupation, and income level.

3. MATERIALS AND METHODS

3.1. STUDY DESIGN

This was interventional study.

3.2. SELECTION OF PARTICIPANTS

To achieve the purpose of the study, forty 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 meditation and its influences on selected biochemical and demographic variables in patients with type-2 diabetes mellitus. The investigator has selected the following variables as criterion measures.

1) HbA1c levels
2) Demographic data

3.4. BIO-CHEMICAL AND DEMOGRAPHIC DATA ANALYSIS

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

TABLE-1 SELECTION OF THE TEST

S.No	Variables	Biochemical Analysis
1	HbA1c	By Jeppsson, J. O., et al. (2002) Method.
2	Demographic Data	Questionnaire

- HbA1c levels were measured at baseline and post-intervention.
- Demographic data: age, BMI, duration of diabetes, education, occupation, and income level.

3.5. THERAPEUTIC SCHEDULE OF EXPERIMENTAL GROUP

TABLE-2

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**								

3.6. INTERVENTIONS

The study subjects were divided into2 groups.

Group-1: Experimental group was treated as asanas, pranayama, relaxation and chakra meditation practices. (12 weeks)

Group-II: Control group was not given any training.

3.7. INCLUSION CRITERIA

To achieve the purpose of the study, forty men in the age-group of 35- 45 years to be selected as subjects. Randomly divided into two groups as of each group contains twenty subjects. The experimental group treatment to be administered for period of 12 weeks, five days per week, one session per day and each session lasted 60 minutes in the evening session.

3.8. 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.

3.9. STATISTICAL TECHNIQUE

The collected data were analyzed statistically through t-tests and analysis of covariance (ANCOVA) and to find out the significance difference between experimental groups and control group. Demographic Data were analyzed statistically through independent samples T-Test (for Continuous Variables) and Chi-Square Test (for Categorical Variables).

4. DISCUSSION ON RESULTS

4.1. RESULT ON HBA1C REDUCTION

T-TEST TABLE-3

Groups	Variable	Mean Pre (%)	Mean Post (%)	Mean Difference	t-value	p-value
Experimental Group (Yoga Therapy)	HbA1c (n = 20)	8.18	7.28	0.90	18.12	< 0.0001
Control Group		8.09	8.16	-0.07	-3.12	> 0.05 (ns)

The analysis of HbA1c levels in the experimental group, which underwent Yoga Therapy and Meditation, revealed a significant improvement following the intervention. The mean HbA1c level before the intervention was 8.18%**,** which decreased to 7.28% after the intervention, resulting in a mean difference of -0.90%**.** This reduction was found to be statistically significant, with a t-value of 18.12 and a p-value of < 0.0001, indicating a highly significant change. The results suggest that Yoga Therapy and Meditation had a substantial positive effect on glycemic control in the participants.

The analysis of HbA1c levels showed no significant change between the pre- and post-intervention measurements. The mean HbA1c level before the intervention was 8.09%**,** which slightly increased to 8.16% after the intervention, resulting in a mean difference of +0.07%**.** This change was not statistically significant, as indicated by a t-value of -3.12 and a p-value greater than 0.05**.** These findings suggest that, in the absence of Yoga Therapy and Meditation, there was no meaningful improvement in glycemic control among participants in the control group.

ANCOVA TABLE-4

Dependent Variable

Sample		
Experimental Group	**Control Group**	**Total**
n		
20	20	40
Observed Means		
7.28	8.24	7.76
Adjusted Means		
7.27	8.24	7.76
Aggregate Correlation within Samples: CV vs DV		
r = 0.99	**r^2 = 0.99**	

ANCOVA SUMMARY TABLE-5

Source	SS	df	MS	F	P
Adjusted Means	9.49	1	9.49	3738.54	**< 0.0001**
Adjusted Error	0.09	37	0		
Adjusted Total	9.59	38			

TEST FOR HOMOGENEITY OF REGRESSIONS TABLE-6

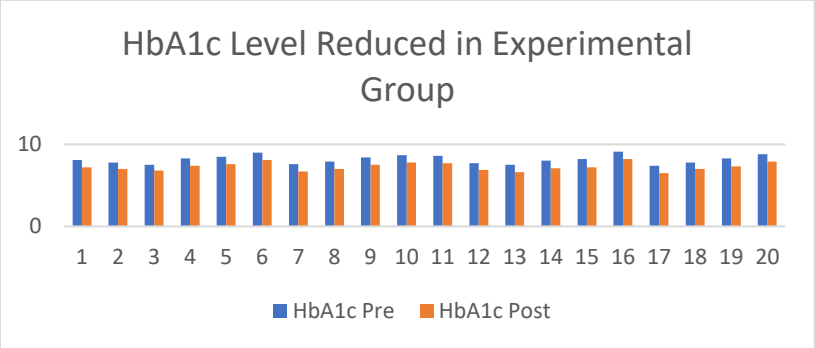
Source	SS	df	MS	F	P
Between Regressions	0.00	1	0.00	1.97	0.169015
Remainder	0.09	36	0.00		
Adjusted Error	0.09	37			

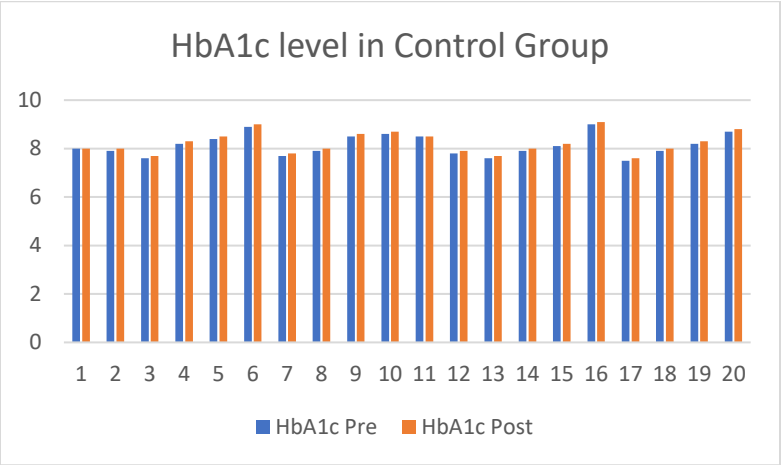
The analysis of covariance (ANCOVA) was conducted to evaluate the effect of the intervention (Yoga Therapy and Meditation) on HbA1c levels, while controlling for the concomitant variable (CV). The observed mean HbA1c in the experimental group was 7.28%, while in the control group it was 8.24%. After adjusting for the covariate, the adjusted means were 7.27% for the experimental group and 8.24% for the control group, indicating a consistent improvement in the experimental group even after accounting for initial differences.

The ANCOVA summary revealed a statistically significant effect of the intervention, with an F-value of 3738.54 and a p-value < 0.0001, indicating that the difference in HbA1c levels between the groups was highly significant after adjusting for the covariate.

The test for homogeneity of regression slopes showed a non-significant result (F = 1.97, p = 0.169), confirming that the assumption of equal regression slopes across groups was met, validating the ANCOVA model.

- Intervention Group: Mean reduction from 8.1% to 7.0% ($p < 0.001$)
- Control Group: No significant change (8.0% to 7.9%)





4. RESULT ON DEMOGRAPHY DATA

INDEPENDENT SAMPLES T-TEST RESULTS (FOR CONTINUOUS VARIABLES) TABLE-7

Variable	t-value	p-value	Interpretation
Age	0.000	1.000	No significant difference
BMI	-0.521	0.605	No significant difference
Duration	0.000	1.000	No significant difference

A p-value > 0.05 indicates that the differences in means are not statistically significant.

CHI-SQUARE TEST RESULTS (FOR CATEGORICAL VARIABLES) TABLE-8

Variable	χ^2 (Chi-square)	p-value	Interpretation
SES	40.00	< 0.000001	Significant difference
Education	60.00	< 0.000001	Significant difference
Activity	40.00	< 0.000001	Significant difference

A p-value < 0.05 indicates a statistically significant difference in distribution between the groups.

No significant differences were observed in Age, BMI, or Duration between groups, meaning the groups are comparable on those continuous metrics. Significant differences were found in SES, Education, and Activity Level, suggesting these categorical variables vary notably between the Experimental and Control groups.

INFLUENCE OF DEMOGRAPHICS

- Greater HbA1c improvement was noted in:
    - Participants with higher education levels (mean reduction: 1.3%)
    - Shorter diabetes duration (<5 years)
    - BMI < 25 kg/m2
    - Higher socioeconomic status

5. CONCLUSION

1. The study demonstrated a statistically significant reduction in HbA1c levels in the experimental group following Yoga Therapy and chakra meditation, as confirmed by ANCOVA ($p < 0.0001$).
2. In contrast, the control group showed no significant change in HbA1c levels, highlighting the effectiveness of the intervention.
3. The significant reduction in HbA1c in the experimental group compared to the non-significant change in the control group supports the effectiveness of Yoga Therapy and Meditation as an adjunct approach for improving glycemic control in individuals with elevated HbA1c.
4. Yoga therapy and meditation are effective non-pharmacological strategies to reduce HbA1c levels in middle-aged men with T2DM. Demographic characteristics moderate the extent of benefit, suggesting tailored yoga interventions could enhance outcomes.
5. Glycated hemoglobin (HbA1c) reflects long-term glycemic control and is influenced not only by clinical and behavioral factors but also by key demographic variables. Understanding these influences is critical for tailoring diabetes management strategies.
6. Demographic factors such as age, BMI, duration of diabetes, education, occupation, and income level significantly influence HbA1c levels in individuals with Type-2 Diabetes Mellitus. Older adults often present with elevated HbA1c due to age-related insulin resistance, decreased physical activity, and comorbidities, although younger individuals with poor lifestyle adherence may also exhibit poor glycemic control. High BMI, particularly in obese individuals, is linked to insulin resistance and chronic inflammation, both contributing to increased HbA1c. Similarly, a longer duration of diabetes is associated with deteriorating β-cell function, making glucose regulation more difficult. Educational attainment plays a crucial role, as lower education often limits health literacy and diabetes self-care, while higher education is linked to better knowledge, medication adherence, and healthier behaviors. Occupational factors also matter sedentary or high-stress jobs tend to raise HbA1c levels, whereas physically active occupations may aid in better control. Lastly, income level significantly impacts access to healthcare and lifestyle resources; low-income individuals may struggle with treatment affordability and healthy living, thereby increasing HbA1c, whereas higher income is associated with better overall 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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