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A Pilot Study On The Efficacy Of Combined Yoga And Siddha Interventions In The Management Of Type 2 Diabetes

Dr. Rajalakshmi B[1], Dr. Meena Ramanathan[2], Dr. Ananda Balayogi Bhavanani[3], Dr. Sridharan R[4], Dr Arun S[5]

[1]Medical Officer (Siddha), Directorate of Ayush, Govt of Puducherry, Ph.D Scholar in Yoga Therapy, School of yoga therapy, ISCM, Sri Balaji Vidyapeeth, Puducherry-607402, Puducherry, India

[2]Principal, School of Yoga therapy, ISCM, Mahatma Gandhi Medical College, SBV Campus, Sri Balaji Vidyapeeth, Puducherry-607402, Puducherry, India

[3]Director, ISCM, Sri Balaji Vidyapeeth, Puducherry-607402, Puducherry, India

[4]Director, Directorate of Ayush, Govt of Puducherry – 605001, Puducherry, India

[5]Associate Professor, Dept of Community Medicine, Mahatma Gandhi Medical College and Research Institute, Puducherry- 607402, Puducherry, India

Abstract

Background: *Diabetes poses a significant threat to public health, underscores the urgent need for effective and sustainable management strategies. Traditional Indian systems, Siddha and Yoga offer holistic approaches that emphasize the overall well-being and can be integrated into modern diabetic health care.*

Objective: *To investigate the impact of a yoga and siddha intervention together in the treatment of type 2 diabetes*

Design: *Randomised controlled pilot study*

Methods: *Thirty diagnosed type 2 diabetic patients were randomized into YoSi (Integrated Yoga and Siddha) group (n=15), which received yoga interventions 2 times a week for 3 months with standard Siddha medication, and the Siddha group (n=15), which received standard Siddha medication alone. Pre- and post-assessments included Body Mass Index (BMI), glycated haemoglobin (HbA1c), fasting insulin, Homeostatic Model Assessment of Insulin Resistance (HOMA-IR), lipid profile and Perceived Stress Scale (PSS).*

Results: *In YoSi group, there were significant reductions in BMI (p = 0.001), HbA1c (p = 0.001), fasting insulin (p = 0.02), HOMA-IR (p = 0.001), total cholesterol (p = 0.015), LDL (p = 0.001), and an increase in HDL (p = 0.020). The Siddha group also demonstrated significant reductions in BMI (p = 0.010), HbA1c (p = 0.000), fasting insulin (p = 0.025) HOMA-IR (p = 0.003) and total cholesterol (p = 0.033), However, YoSi group achieved a more pronounced reductions in HbA1c (mean difference -1.84% vs -1.45%, p=0.056), and lipid parameters. Both groups demonstrated a significant decrease in PSS, with much greater decrease in YoSi group (median delta 50% vs 21%, p=0.001). P<0.05 is considered significant*

Conclusions: *The YoSi intervention shows potential benefits in managing type 2 diabetes. It showed improved glycaemic control, BMI, lipid profiles, and stress levels indicating the positive advantages in addressing both metabolic and psychological aspects of the disease. Larger randomised controlled trials are needed to confirm efficacy.*

Keywords: *Integration, Yoga, Siddha, HOMA IR, holistic, diabetes*

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a chronic metabolic condition that affects 589 million adults globally, with projections indicating an increase to 853 million by 2050 [1]. Lifestyle modifications are critical for prevention and management, particularly in developing countries where urbanisation and ageing increase prevalence that can be addressed through cost-effective, preventive measures, healthy living, improved nutrition, access to health care and awareness [2]. The WHO Traditional Medicine Strategy (2014–2023) promotes integrating safe, effective traditional systems like AYUSH (Ayurveda, Yoga, Unani, Siddha & Homeopathy) into healthcare to support overall well-being and universal health coverage [3]. AYUSH systems promote holistic, personalized and preventive healthcare, yet greater awareness and research are needed to integrate effectively with modern healthcare system [4]. India's 2017 National Health Policy advocates

mainstreaming AYUSH for cost-effective, holistic care improving primary healthcare outcomes and achieving universal health [5]. The Siddha medical system and Yoga, are integral parts of the AYUSH stream, found by Siddhars and saints emphasize treating the individual at all levels (body, mind, and soul) to promote a healthy way of living. The fundamental ideas of Siddha are explained along with the yogic techniques in Tirumoolar's Tirumantiram and Yogam is considered as a kayakarpam technique in siddha system [6]. Siddha medicine, an ancient South Indian system, correlates diabetes to Madhumegam, offering herbal formulations and lifestyle interventions [7]. Studies suggest Siddha medications (e.g., Mathumeganoi choornam, Triphala) improve glycaemic control and reduce complications [8, 9]. Yoga, a complementary AYUSH practice, enhances glycaemic control, BMI, lipid profiles, and psychological well-being in T2DM through regular practice [10, 11, and 12].Yoga, traditionally practiced for rejuvenation and longevity, has over time evolved into a therapeutic discipline that complements other medical systems with its cost-effectiveness and wide-ranging health benefits. Together Siddha and Yoga may create a comprehensive pathway toward balanced and holistic healing. As standalone interventions, both Yoga and Siddha medicine have demonstrated potential in the management of T2DM. However an observational study (limited by its small sample size of 10 subjects and without a control group) done by Mirunaleni et al, established that an integrated Siddha and yoga module is safe, feasible and may lower the need of allopathic medicine with adequate glycaemic control in T2DM patients. [13] No previous studies have investigated the combined impact of physiological, biochemical, and psychological dimensions with integrated yoga and siddha intervention. The present pilot study evaluates the potential impact of a synergized approach combining an integrated Yoga and Siddha practices on BMI, glycaemic control, lipid profile, and stress levels in individuals with T2DM, aiming to inform larger trials.

METHODS

Study Design and Setting

This randomised controlled pilot study was conducted in a primary care hospital in Puducherry, India, from June to October 2020. The study was approved by the Institutional Human Ethics Committee (PhD PROJECT/08/2019/008, 23/08/2019) and registered with the Clinical Trial Registry of India (CTRI/2020/03/024086). The study is a component of the ongoing PhD thesis.

Participants

Eligible participants were adults aged 35–70 years with T2DM (HbA1c 7–10%), no diabetic complications, and ability to perform yoga. Exclusion criteria included insulin therapy, severe comorbidities, or pregnancy. The purpose of this study was explained to the participants and informed consent was taken after their acceptance to participate in the study. 30 eligible subjects (23 male; 7 female) were randomised (1:1) to the YoSi (integrated Yoga-Siddha) group (n=15) or Siddha group (n=15) using computer-generated randomisation.

Interventions

The YoSi group received Yoga intervention for 3 months twice weekly for 45 minutes led by qualified yoga therapists, Yoga practices was given according to the participants ability starting from prayer to relaxation techinques, which includes loosening practices followed by asana practices such as Talasana ,Trikonasana, Ardha Katichakrasana, Vakrasana, Jatara Parivrittanasana, Pavanamuktasana, Viparitakarani followed by Pranayama practices namely Nadi Shuddhi Pranayama and Bhramari Pranayama and finally, end the session with Marmanasthanam Kriya to experience complete relaxation, plus daily Siddha medications (Mathumeganoi, Triphala, Keezhanelli tablets). The Siddha group received the Siddha medications. Both groups received dietary and lifestyle advice. Participants maintained compliance diaries, and home practice was encouraged for the YoSi group.

Outcome Measures

The Primary outcomes comprised changes from initial level to three months in:

- Glycaemic parameters (HbA1c, fasting insulin and HOMA-IR).
- Physiological parameter (BMI).

- Lipid parameters (Total cholesterol, HDL [high-density lipoprotein], LDL [low-density lipoprotein] and triglycerides).
- Psychological parameter (PSS, Greater stress is indicated by higher PSS scores, which range from 0 to 40).

Blood samples were analysed by blinded technicians at the Government General Hospital. PSS questionnaires were self-administered pre- and post-intervention.

Statistical Analysis

Baseline characteristics were compared using chi-square tests. Pre- and post-intervention changes within groups were assessed with paired t-tests. Between-group differences in median delta percentage changes were evaluated using Mann-Whitney tests. A p-value <0.05 was considered significant. Data are presented as mean ± SD or median (IQR).

RESULTS

Baseline Characteristics

Groups were comparable in age (YoSi: 52.9 ± 8.7 years; Siddha: 54.6 ± 9.7 years, p=0.62), gender (p=0.195), education (p=0.82), marital status (p=0.34), socioeconomic status (p=1.0), type of family (p=1.0), occupation (p=0.601), and family history of diabetes (p=0.624) (Table 1).

Table 1: Baseline Sociodemographic Characteristics between Yosi and the Siddha group

	Parameters	YoSi group (n=15)	Siddha group(n=15)	Total	Chi-square test (p value)
Gender	Female	5(33.33)	2(13.33)	7(23.33)	0.195
	Male	10(66.67)	13(86.67)	23(76.67)	
Education	Hr.Sec. school	7(46.67)	6(40)	13(43.33)	0.82
	Illiterate	1(6.67)	0 (0)	1(3.33)	
	PG	1(6.67)	2 (13.33)	3 (10)	
	Primary	4(26.67)	5(33.33)	9 (30)	
	UG	2(13.33)	2 (13.33)	4 (13.33)	
Marital status	Married	13(86.67)	15(100)	28 (93.33)	0.34
	Unmarried	1(6.67)	0(0)	1(3.33)	
	Widow	1(6.67)	0(0)	1(3.33)	
Socio-economic status	Lower Class	8(53.33)	8(53.33)	16(53.33)	1.0
	Middle Class	7(46.67)	7(46.67)	14(46.67)	
Type of family	Extended	5(33.33)	4(26.67)	9(30)	1.0
	Nuclear	10(66.67)	11(73.33)	21(70)	
Occupation	Employed	9(60)	9(60)	18(60)	0.601
	Housewife	3(20)	2(13.33)	5(16.67)	
	Retired	1(6.67)	0(0)	1(3.33)	
	Unemployed	2(13.33)	4(26.67)	6(20)	
Family history of Diabetes	No	2(13.33)	3(20)	5(16.67)	0.624
	Yes	13(86.67)	12(80)	25(83.33)	

Both groups showed significant within-group improvements (Table 2). The YoSi group had greater reductions in HbA1c (-1.84 ± 0.61% vs -1.45 ± 0.45%, p=0.056), HOMA-IR (-1.83 ± 1.0 vs -1.63 ± 0.91, p=0.305), and

BMI (-0.94 ± 0.87 vs -0.45 ± 0.97, p=0.067) compared with the Siddha group, though between-group differences were not statistically significant

Table 2: Pre and post intervention of Physiological and Glycaemic Outcomes of both the study groups

Parameters	Group	Pre intervention Mean ±SD (n=15)	Post intervention Mean ±SD (N=15)	p value (Paired t test)
BMI	YoSi	24.65 ± 3.17	23.71 ± 2.87	0.001***
	Siddha	25.84 ± 3.52	25.39 ± 3.07	0.010**
Hb1Ac (%)	YoSi	8.39 ± 0.82	6.55 ± 0.61	0.001***
	Siddha	8.87 ± 0.77	7.42 ± 0.45	0.001***
Fasting insulin (µIU/ml)	YoSi	8.53 ± 4.6	5.19 ± 2.78	0.020*
	Siddha	8.08 ± 2.75	5.88 ± 1.63	0.025*
HOMA IR	YoSi	3.67 ± 2.17	1.84 ± 1	0.001***
	Siddha	4.03 ± 1.62	2.4 ± 0.91	0.003**

Data were represented as mean ± SD. SD: Standard deviation, BMI: Body mass index, HbA1c: Glycosylated hemoglobin, HOMA IR: Homeostatic Model Assessment for Insulin Resistance. p value <0.05 was considered as significant *(p value <0.05), ** (p value <0.01) *** (p value <0.001)

Both groups showed significant within-group improvements (Table 2). The YoSi group had greater reductions in HbA1c (-1.84 ± 0.61% vs -1.45 ± 0.45%, p=0.056), HOMA-IR (-1.83 ± 1.0 vs -1.63 ± 0.91, p=0.305), and BMI (-0.94 ± 0.87 vs -0.45 ± 0.97, p=0.067) compared with the Siddha group, though between-group differences were not statistically significant

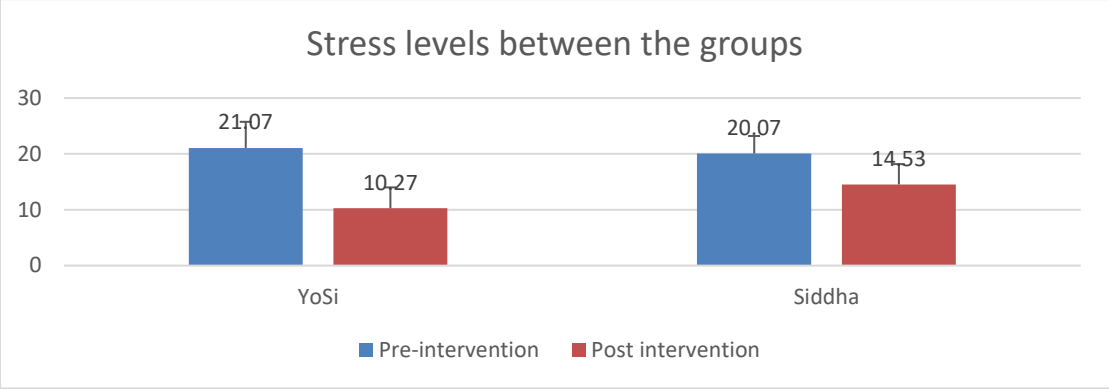
Table 3: Pre and post intervention of Lipid variables of both the study groups

Parameters	Group	Pre intervention Mean ±SD (n=15)	Post intervention Mean ±SD (n=15)	p value (Paired t test)
Total cholesterol (mg/dl)	YoSi	205.6 ± 56.42	177 ± 39.84	0.015**
	Siddha	212.2 ± 56.62	192.4 ± 29.32	0.033*
HDL (mg/dl)	YoSi	39.93 ± 8.51	45.13 ± 5.59	0.020*
	Siddha	40.07 ± 6.53	42.13 ± 3.87	0.102
LDL (mg/dl)	YoSi	148 ± 28.51	125.87 ± 24.63	0.001***
	Siddha	138.2 ± 33.53	132.53 ± 19.25	0.277
TG (mg/dl)	YoSi	160.33 ± 102.05	118.93 ± 55.78	0.104
	Siddha	146.33 ± 86.95	137.87 ± 61	0.427

Data were represented as mean ± SD. SD: Standard deviation, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, TG: Triglyceride. p value <0.05 was considered as significant *(p value <0.05), ** (p value <0.01) *** (p value <0.001)

Lipid profiles improved more in the YoSi group, with significant reductions in total cholesterol (-28.6 ± 39.84 mg/dL, p=0.015), LDL (-22.13 ± 24.63 mg/dL, p=0.001), and increased HDL (+5.20 ± 5.59 mg/dL, p=0.020) (Table 3). The Siddha group showed a significant reduction only in total cholesterol (-19.8 ± 29.32 mg/dL, p=0.033).

Figure: Pre and post intervention of stress levels between the study groups



Stress levels (PSS) decreased significantly in both groups, but the yoga-Siddha group showed a greater reduction (median delta 50% vs 21%, p=0.001) (Table 4 & 5).

Table 4: Median delta percentage changes (pre-post intervention) of key physiological, biochemical and psychological parameters between the two study groups.

Parameters	YoSi group (n=15) (Median, IQR)	Siddha group (n=15) (Median, IQR)	p value (Mann-whitney test)
BMI	3.63 (0.89 - 6.89)	1.42 (0.00 - 2.22)	0.067
Hb1Ac	20.93 (15.89-26.53)	17.34 (12.16 - 21.11)	0.056
Fasting Insulin	36.13 (9.58 - 53.77)	22.10 (3.34- 41.230	0.267
HOMA IR	48.29 (19.31 - 64.54)	33.21 (15.83 - 53.64)	0.305
Cholesterol	12.03 (5.38-17.39)	9.25 (-2.01- 15.00)	0.683
HDL	-9.30 (-20~2.22)	2.27 (-14.28 - 2.33)	0.250
LDL	11.89 (5.83-18.12)	8.27 (-11.11 - 14.11)	0.061
TG	15.07 (4.59 - 27.77)	6 (-15.70- 21.81)	0.137
PSS	50 (37.5 - 65.38)	21.05 (11.76 - 31.81)	0.001***

*(p value <0.05), ** (p value <0.01) *** (p value <0.001)

DISCUSSION

Siddha and yoga are both renowned ancient practices that have long been used to support holistic wellness. . In this study the baseline demographic characteristics such as age, gender, education, socioeconomic status, family structure, occupation, and family history of diabetes were comparable between the groups, [Table 1]with no statistically significant differences ($p > 0.05$), ensuring that outcome comparisons were unbiased. Both groups showed statistically significant improvements in glycaemic control following the intervention, However, the YoSi group shows superior reduction in HbA1c (-1.84% vs -1.45%)[Table 2] that aligns with prior studies showing yoga's benefits in glycaemic control [10, 14].

Regular yoga practice may be a good alternative treatment for controlling obesity and increasing health in obese teens, according to the results of a successful yoga intervention study. [15] According to a Dewangani et al's review yoga plays a significant role in the prevention and management of T2DM through the improvement of weight, glycaemic variables, lipid variables, and oxidative stress. [16] Gowri et al findings concludes that people with diabetes can benefit greatly from integrated yoga therapy as a non-invasive adjuvant modality showing significant findings in blood sugar levels , insulin resistance and other biochemical variables. [17] Siddha medications also improved glycaemic parameters, consistent with evidence on herbal formulations provides positive care in preventing and managing diabetic complications [18]

Siddha interventional studies also proved beneficial as Vijay Kumar et al states that Siddha therapy may help to regulate blood sugar levels, enhance quality of life, and avoid complications and insist the need for validation by conducting more studies including bigger patient cohorts and randomized controlled trials.[19]

A review also suggest that for potential approach to manage diabetes, traditional modalities like Siddha may be combined with contemporary treatment to enhance results and lessen adverse effects as it addresses underlying problems and restore balance by integrating lifestyle, diet and customized medicine. [20]
The combined intervention's impact on lipid profiles, particularly LDL and HDL,[Table 3] supports yoga's cardioprotective effects. Integrated approach of Yoga, incorporating practices and stress management strategies, positively acts on the raised lipid levels, BMI and diabetic complications. [21] A meta-analytic study findings shows that yoga therapies significantly and favourably affect the management of lipid profiles and the results add credibility to the increasing amount of research that suggests yoga as a useful adjunctive treatment for dyslipidemia.[22] Perceived Stress scores, reduced significantly in both groups, [Figure] however, the degree of stress reduction was notably higher in the YoSi group (50% vs 21%) [Table 4] highlighting the potential psychological benefit of integrating Yoga therapy with Siddha treatment in stress management, a critical factor in diabetes care. The significant reduction in PSS scores in the YoSi group (50% vs 21%) [Table 5] highlights yoga's role in stress management, a critical factor in diabetes care. High levels of perceived stress have been repeatedly associated with elevated HbA1c and fasting blood sugar (FBS) levels, highlighting the crucial role of stress management in the prevention and treatment of diabetes [23] Yoga, as supported by an increasing evidence of research, has been demonstrated to successfully reduce stress and improve glycaemic control, making it a promising complementary approach in diabetes management. [24, 25] A National Non-communicable Disease Monitoring Survey (NNMS) concludes that it is crucial to implement a holistic approach and recommends to incorporate AYUSH into diabetes care to combat this escalating health concern [26] Overall this pilot study demonstrates that the YoSi intervention showed greater improvements in HbA1c, HOMA-IR, BMI, lipid profiles, and stress levels compared with Siddha alone, though between-group differences were not always statistically significant due to the small sample size.
This shows that our study supports the integration of AYUSH systems into primary care, aligning with India's National Health Policy [4]. Combining Yoga and Siddha offers a holistic, cost-effective approach to diabetes management, addressing physiological and psychological needs. Larger randomised controlled trials are warranted to confirm efficacy and guide clinical implementation.

Limitations

This includes small sample size, short intervention duration, and lack of a yoga-only control group, limiting generalizability. The study was conducted in a specific cultural context, potentially affecting applicability elsewhere. Future trials should include larger samples, longer follow-ups, and additional control arms to isolate Siddha and Yoga's potential.

CONCLUSION

The integrated Yoga and Siddha intervention, YoSi shows preliminary efficacy in improving glycaemic control, BMI, lipid profiles, and stress levels in type 2 diabetes. While both intervention groups showed significant improvements in metabolic, biochemical, and psychological parameters, the YoSi group outperformed the Siddha group, particularly in stress reduction. These findings support the feasibility and potential efficacy of combining traditional Siddha medicine with Yoga practices and justify larger trials to validate the combined approach and support its integration into diabetes care.

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