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Impact of Yoga Therapy for the Management of Type-2 Diabetes: A Systematic Review

Review Article

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Abstract

Background: The most prevalent type of diabetes, type 2 diabetes mellitus (T2DM), accounts for more than 90% of cases of diabetes globally. As of right now, 425 million adults worldwide are believed to have type-2 diabetes; by 2045, that number is expected to increase to 629 million. The main cause of T2DM is the deterioration of the regular functioning of pancreatic (β-cells) and insulin resistance. Yogic therapy is a proven method of stabilizing an individual from a metabolic disorder, and lifestyle disorder. Through asanas and pranayama, we can control the blood sugar level. Objective: To assess Yoga Therapy's effectiveness for managing Madhumeha (Diabetes mellitus-II) in the review article. Design: The PubMed, Google Scholar, Embase, and Cochrane databases were searched from January 2022 to February 2023 for eligible RCTs using the keywords 'Yoga Therapy' and 'Type-II Diabetes Mellitus'. Intervention: Treatment with any regimen of Yoga Therapy or Yogic Intervention (Asana, Pranayama). Outcome Measures: The number and results of the studies were identified and presented as a systematic review. Result: This systematic review resulted in understanding the different mechanisms by which Yoga Therapy works in type-2 Diabetes Mellitus. Which include Asanas and Pranayama, were effective in regulating fasting blood sugar ($p < 0.05$), Postprandial Fasting blood Sugar level ($p < 0.0001$), HbA1c ($p < 0.001$), Triglyceride (($p<0.05$), Low-Density Lipoprotein ($p>0.05$) and High-Density Lipoprotein ($p<0.05$), BMI Body Mass Index ($p < 0.001$), BP Blood Pressure ($P= 0.072$), Serum (p-value <0.0001) relative to the control group.

Keywords: Diabetes Mellitus, *Yoga, Asana, Pranayama*.

Introduction

Worldwide, diabetes mellitus has grown to be a serious health concern. One of the diseases with the fastest rate of worldwide disease growth is diabetes, according to recent data from the International Diabetes Federation (IDF) (1). The WHO estimates that 463 million people worldwide had Type-2 diabetes in 2019, and that number is expected to rise to 578 million by 2030 and 700 million by 2045. It is a complex metabolic disorder characterized by hyperglycemia and glucose intolerance resulting from defects in insulin secretion; the action of the produced insulin is ineffective, or both (2). Yoga was developed as a traditional mind-body practice about 5000 years ago in India. In the modern scenario, Yoga is becoming more popular daily due to its possible benefits in preventing the onset of various diseases and their related complications. The effectiveness of Yoga therapy has been studied in several chronic diseases, such as hypertension, asthma, chronic obstructive pulmonary disease, and diabetes (3). Previous studies have reported that Yoga Therapy might reduce Insulin Resistance Syndrome, an exclusive collection of risk factors for the development of T2DM, and has shown promising results in improving signs, improving prognosis, and reducing complications (4). The science of Yoga has proven its usefulness in treating certain diseases and preserving health in normal individuals. Studies have shown the useful role of Yoga Therapy in the management of type-2 diabetes mellitus by reducing fasting and postprandial blood sugar levels significantly. The benefits of Yoga Therapy include long-term control of blood sugar levels, reduced requirement of medicines, and reduction in acute complications (5). Yoga Therapy is a lifestyle intervention practice that has been identified and proven to benefit T2DM through several studies. Yoga is one of the cost-effective and non-pharmacological ways of adopting a healthy lifestyle. Multiple studies recommended the role of Yoga in the amelioration of type-2 diabetes mellitus in an effective way. Yoga Therapy is believed to exert long-term glycemic control. However, reduction in weight optimal glucose levels, and wellness can be achieved by regular Yogic practices. Yoga comprises various physical and respiratory exercises therefore it can be a suitable integral therapy for diabetic patients

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mediated by improvement of muscular-skeletal and cardiopulmonary function and also by improving mental health. However, the condition can be regulated with increased community awareness and care at the type-2 diabetes mellitus level. Yogic practices can be effectively used as a preventive care treatment in diabetic mellitus individuals.

Methods of the Systematic Review

Each trial's titles and abstracts were first reviewed to identify suitable studies for inclusion. The reviewing process considered the presence of adult patients with Madhumeha (Diabetes Mellitus-II). Papers that might be qualified were retrieved for a closer examination. Furthermore, we manually searched our records, the reference portions of current reviews on yoga and diabetes, and the citation sections of all identified articles.

Objective

To assess Yoga Therapy's effectiveness for managing Madhumeha (Diabetes mellitus-II) in the systematic review article.

Inclusion Criteria

- Age group >25 years and <74years
- Participants in the study must have type-2 diabetes mellitus.
- The study compared a control group to an experimental group that practices Yoga, pranayama, and meditation to improve the treatment of type-2 diabetes mellitus.
- Study exploring the circumstances in the intervention and control groups for glycemic control and other type-2 diabetes Mellitus management metrics such as HbA1c, FPS, PPBS, body mass index, Lipid Profile, BP, systolic and diastolic blood pressure.

Exclusion Criteria

- Participants of a specific age group aged <25 and > 74 years.
- Participants in the research had comorbid conditions such as diabetic retinopathy and nephropathy.
- Excluded are studies from conference proceedings, book reviews, commentary books, and book chapters.
- Study exploring the circumstances in the intervention and control groups for glycemic control type-2 diabetes management metrics such as HbA1c, fasting blood sugar, PP, systolic and diastolic blood pressure.

Type of interventions

Interventions were included in the study, which mentioned yoga interventions in the respective publications.

Other Search Strategies

The list of references for each of the relevant studies was searched. Experts and authors in diabetes care or Yoga were contacted for any studies that were not included at this point. The PubMed, Google Scholar, Embase, and Cochrane databases were searched from January 2022 to February 2023 for eligible RCTs using the keywords 'Yogic Practice' and 'Type-II Diabetes Mellitus'. Eligible trials were limited to adult human subjects, and only trials published with the full text and written in English were included in this work. The bibliographies of all potentially eligible studies, including reference lists, citation searches, and relevant systematic reviews, were searched by hand to ensure literature saturation.

Data Extraction

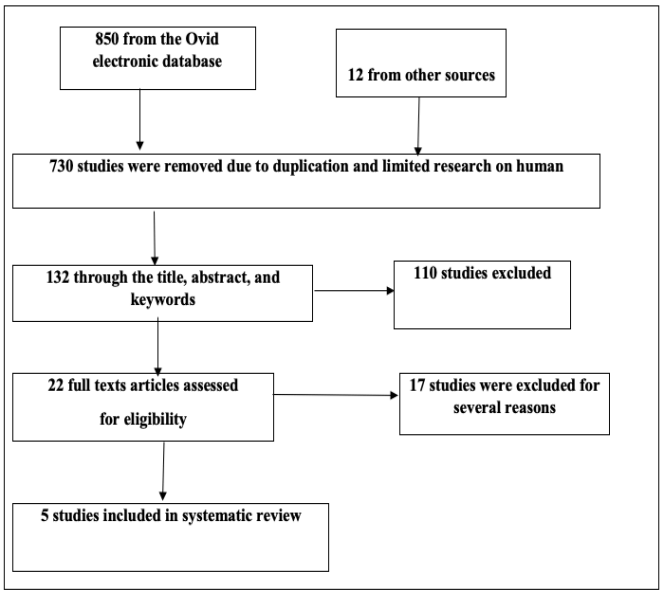
- The extracted details regarding the relevant studies were done using a data extraction form.
- The data extraction form collected information on the following items: methodological characteristics, study general information, demographic variables, Yogic intervention, duration, control groups, outcomes assessment, follow-up; and others. Finally, all differences will be resolved by consensus.

Results

A total of 862 studies were identified of these 850 studies were identified through the electronic search and 12 from other sources. From the initial searches of electronic databases, 850 citations (100 from Google Scholar, 350 from Cochrane Library, 300 from EMBASE, 50 from CINAHL, and 50 from PubMed). The titles and abstracts of these citations were reviewed. This resulted in 22 relevant citations of which the full text was received. After the final review of these texts, only five studies were included in this review. Reviewing the titles and abstracts of these studies resulted in seven studies in which their full text was retrieved and gave a final relevancy of 5 studies.

PRISMA: (Preferred Reporting Items for Systematic Reviews) diagram of search results from a systematic review (6).

Figure 1: Flow Chart of Searching Strategy of the Systematic Review



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Excluded Studies

A total of 17 studies were excluded in this systematic review article. Six studies were pre-post type of studies in which the participants acted as their control but without a separate control group. Five studies were reviews or discussions of the role of Yoga practice on diabetes but they were not trials. In three of the excluded studies, the intervention was not Yoga practice or it was not clear that Yoga practice was included and finally, three of the studies were not exclusive type II diabetic patients. These were the main reasons but some of these studies were excluded for more than one reason. No other outcomes were reported from any of the trials if they were not proposed originally in this review.

Table 1: Reasons for Excluded Studies

Excluded Study	Reason for Excluded
Amanda R. Bonikowske et al (7).	Trial Design: Pre-post-trial with no control group.
Bhavani Ahilan et al (8).	Trial Design: A review of Yoga effect on Type-2 diabetes but it was not a trial.
Manoj Sharma, et al (9).	Trial Design: A mini-review of relaxation techniques that was not a trial.
Vijaya Duraiswamy et al (10).	Trial Design: Pre-post-trial with no control group.
Maricarmen vizcaino et al (11).	Trial Design: A Review of Yoga Effect on Pilot Study in Diabetes.
Vanelli et al. et al (12).	Population: Type-2 Diabetic patients younger than 18 years.
Kerr et al (13).	Population: both type I and type II diabetes patients.
Ramya Ramamoorthi et al (14).	Population: The participants are out of range in inclusion criteria.
Khemayanto hidayat et al (15).	Intervention: Diet with a comprehensive lifestyle modification therapy involving diet.
Yadav Sunil Kumar et al (16).	Trial Design: Pre-post-trial with no control group.
Senthil Raj Thangasam et al (17).	Intervention: Biofeedback-assisted relaxation with mention of the usage of Yoga practices.
Khalsa et al (18).	Trial Design: A review not a trial on Yoga effect on several diseases including diabetes and other diseases.
Singh et al (19).	Trial Design: Pre-post-trial with no control group.
Tsujiuchi et al (20).	Intervention: Used alternative medicine interventions that did not include Yoga Therapy.
Shashikant Prajapati et al (21).	Trial Design: A review of Yoga effect on diabetes but it was not a trial.
P Kumaravelu et al (22).	Trial Design: Pre-post-trial with no control group.
Sudhan P, et al (23).	Trial Design: Pre-post-trial with no control group.

Studies and Participants

A total of five studies were included in this systematic review with 10 arms, comparing the intervention of Yoga practice alone or combined with other modes of interventions. Five arms participants 3 months at the latest 3 days/per week and another 5 weeks / 20 minutes a day (32-33). One arm and 44 patients regular Yoga practices for 3 months and 1 hour per day, and one arm and 60 participants 1 hour daily for more than 5 years (33). and the last arm with 64 participants 75min per week.

Exclusion Criteria of the Studies

In the included studies, the following were used as exclusion criteria for participants: Type-1 diabetes Mellitus will be excluded, severely ill patients, post-operative cases, drug abusers (under treatment & any other diseases), Persons suffering from any other systemic disorders (High B.P., Peptic ulcer, Heart patients, Kidney & G.B. disorders, Hernia) were excluded, Patients having fasting blood sugar more than 180mg/dl and Postprandial Blood Sugar more than 250mg/dl.

Interventions

Yoga intervention alone was used in three studies (24-25-26). It was combined with Yogic lifestyle modification only in one study. Yogic practices (Asan and Pranayama) were used in one study (27). All participants received Yoga practice training (Asana, Pranayama, meditation). The frequency range of the Yoga therapy sessions differed for example one study had 20-minute sessions per day for one of the trials (28). One study had 1 hour per day sessions in five years (28). and three studies had different sessions for one.

Table 2: Characteristics of Studies Included in the Systematic Review

Sr. No	Author and Year	Intervention	Age	No of patients	Follow Up Period
1	Shree Laxmi V. Hegde, et al. 2011 (29)	Yoga Intervention	40 -75 years	123 Patients	3 Months at least 3 days/ week
2	Duraiswamy et al. 2011 (30)	Yogic Intervention	40- 64 years	20 Patients	5 weeks/ 20 minutes a day.
3	Chattopadhyay K , et al. 2020 (31)	Yoga Intervention	18–74 years	64 Participants	75min per week.
4	Phatak MS et al. 2017 (32)	Yoga Meditation	40-60 years	60 Patients	1 hour daily for more than 5 years
5	P.A Balaji, Smitha R. Varne et al. 2011 (33)	Yoga and pranayama	40-55 years	44 Patients	3 months, 1 hour every day

Selection bias: Randomization and allocation concealment.

Performance bias: Any differences in care provided apart from the intervention

Attrition bias: Any systematic differences in the withdrawals or loss to follow-up. The studies should follow the concept of intention to treat analysis (ITT) with a full explanation of the withdrawal process.

Measurement (detection) bias: Any kind of bias related to the process of reporting the outcome of the studies.

Outcomes

After assessing the characteristics and quality of each trial included in this review, a pooled estimate using meta-analysis was not calculated. This was mainly attributable to the high level of heterogeneity between the characteristics of studies including the specific interventions particularly the method and frequencies in conducting the intervention.

Primary Outcomes

The primary outcome was the measurement of glycemic control (HbA1c), fasting blood glucose (FBG), and postprandial glucose (PPBG).

Fasting Plasma Glucose

Four studies provided results on fasting plasma glucose (FPG) and provided favorable results for the Yoga intervention. There was a statistically significant reduction in FBG concentration in the Yoga group in comparison to the control group. The decline in plasma glucose was more important (FPG $p < 0.05$) (32).

The pooled mean difference of FBG between the Yoga group and control groups from random effects analysis was- p=0.03). Only three studies show the result of PPBS postprandial Blood Sugar levels (33). The mean values of Fasting Blood Sugar and PPBS were significantly higher in diabetics as compared to controls ($p<0.05$), but these values in Yoga practitioners were significantly lower than in non-practitioners ($p<0.05$) (29).

Postprandial Blood Glucose

Three studies provided results on PPBS. These three studies provided favourable results for the intervention in lowering PPBS. There was a statistically significant reduction in PPBS concentration in the Yoga group in comparison to the control group. The pooled mean difference for PPBG between the Yoga group and control groups from random effects analysis was – Postprandial plasma glucose ($p < 0.0001$), 198.47±40.11 ($p<0.05$), Postprandial Plasma Glucose with ($p< 0.001$), [T1- 270.64 + 76.6 to 196.90 + 64.67, T 2 – 230.62 + 71.32 to 183.46 + 52.20] (31-32-33).

Glycolated Hemoglobin

Two studies provided results on HbA1c. These three studies provided valuable results for the intervention in lowering HbA1c. There was a statistically significant reduction in HbA1c concentration in the Yoga intervention group in comparison to the control group. The pooled mean difference for HbA1c between the Yoga intervention group and control groups from random effects analysis was – 6.25% (0.5 6 0.3%), $p < 0.001$ (32-33).

Secondary Outcomes

The secondary outcomes were other markers of type-2 diabetes management including triglycerides, High-density lipoprotein, low-density lipoprotein, blood pressure, BMI, and Serum SOD.

Lipid Profile

Triglycerides

Two of the included trials reported an effect on lowering cholesterol levels. On comparing the mean values of lipid profile in diabetic Yoga practitioners and diabetic non-practitioners it was found that only TC and TG were significantly lower in Yoga practitioners ($p<0.05$). There was a significant decrease with $p < 0.001$ in triglycerides $p<0.001$ (32-33).

Low-Density Lipoprotein

There were two studies in which the effect of Yoga on LDL was studied. The forest plot for LDL shows that there is a significant reduction in LDL in the Yoga group. The mean values of LDL were significantly higher in diabetic non-practitioners as compared to controls ($p>0.05$), $p < 0.001$ (32-33).

High-Density Lipoprotein

Two studies evaluated the effectiveness of Yoga on HDL in comparison to the control group. The mean HDL was significantly lower than controls in all diabetics ($p<0.05$) (32). only one study found no significant change in HDL levels in test groups (33).

Body Mass Index

Three studies evaluated the effectiveness of Yoga practices on BMI. The male and female ratio was 1.5; the average weight and height of individuals in the study group were 65 kgs (65.1±10.5) and 157 cm (157.2±6.5), ($p>0.05$) respectively (32-33). There was a significant decrease in the weight, BMI and waist-hip ratio in both T1 and T2 with $p < 0.001$ Such a substantial change in the control group was not found (30).

Blood Pressure

Only one study evaluated the effectiveness of Yoga intervention on blood Pressure. The results show a significant reduction of systolic blood pressure (SBP) and diastolic blood pressure (DBP) in the Yoga practices group in comparison to the control group ($P = 0.116$) and ($P= 0.072$) with WMD = −1.66 and −0.26, respectively. However, the heterogeneity was mild (32).

Serum

Only one study shows that the test results decreased after practicing Yoga, the serum SOD (superoxide dismutase) enzyme activity levels increased

after the intervention and this was a significant increase (p-value <0.0001) (33).

Discussion

The impact of Yoga therapy on individuals with type-2 diabetes was examined in this review. Only five studies compared Yoga Therapy alone and in combination with additional co-interventions to a control group. We eliminated a lot of pre-post trials to identify high-quality studies. Regrettably, the data quality of the included studies was low. The findings point to the positive effects of Yoga therapy on type-2 diabetes-related short-term parameters, but not always for long-term consequences. The result of the trials' brief duration precluded the detection of long-term effects and the poor power of each trial brought on by its small participant base. Because of the clinical variability among the studies and the possibility of bias resulting from the low quality of the investigations, combining the data from the various studies would not be of scientific use in this systematic review. The included study's low quality may result from improper reporting, methodological flaws, or both. Across the included trials, different levels of methodological flaws including selection bias, randomization, and the use of multiple interventions for confounders were observed. In summary, Yoga therapy is effective for individuals with type-2 diabetes mellitus. The majority of these improvements had an immediate or short-term impact on Type-2 diabetes outcomes and not all of them were statistically significant. The Yoga therapy positively affected short-term glycemic control variables evaluated in this study, including fasting blood glucose and postprandial glucose. The systematic review shows that Yoga therapy had a beneficial effect on type-2 diabetes mellitus glycemic management.

Conclusions

Yoga therapy was beneficial and effective at controlling glycemic parameters in Type-2 diabetes when the correlation coefficient for different anthropometry measures was adjusted. Results from the systematic review show that Yogic therapy (Asana, Pranayama) both are helpful in glycemic control. Finally, we can show that Yoga therapy is very beneficial for type-2 diabetes patients and its efficacy depends on many health variables like human body weight, age, and environment. Patients with type-2 diabetes may benefit in the short term from Yogic practice (Asana, Pranayama). It is necessary to analyze practice specifics (Asana, Pranayama, Meditation) and frequency in the Yoga intervention. This comprehensive systematic review key finding is that large, carefully planned randomized clinical trials are required to determine whether Yoga therapy benefits people with type II diabetes mellitus. These experiments should focus on the methodological soundness and the characterization of Yogic Practice attributes.

The systematic review shows that Yoga therapy had a beneficial effect on type-2 diabetes mellitus glycemic management. In conclusion, there remains a need for systematic evaluation of the health outcomes of Type-2 diabetes and the benefits if any of its early treatment. Yoga therapy (Asana, Pranayama) remains essential to managing Type-2 diabetes.

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