Yoga as an Alternative and Complementary Approach for Controlling Type 2 Diabetes Mellitus: a Systematic Review

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Abstract: Background: Type two diabetes mellitus is a complex and demanding chronic disease. Yoga has been suggested as a complementary and alternative for preventing and controlling type 2 diabetes mellitus. Objectives: The purpose of this study was to review studies using yoga to controlling type 2 diabetes mellitus. Method: A systematic review of studies involving yoga interventions for controlling diabetes was the method used in study. A literature search was conducted in several major database such as scopus, proquest, ScienceDirect, Google Scholar, Pubmed. Inclusion criteria were as follows: (1) conducted between 2012 until 2018; (2) publish in English language; (3) used randomized control trial design. Result: A total of 9 studies met the inclusion criteria. Seven studies used randomized control trial, 1 study used randomized control trial (a feasibility study), and 1 studies used randomized control trial (pilot study). Of these studies, 9 used yoga asanas, 7 used pranayama, and 6 studies used relaxation. All studies that measured FBG, and showed significant decrease FBG. And 3 showed significant improve QoL. Conclusions: Despite the limitations, had nonstandardized yoga intervention, had different outcomes and varying lengths. Yoga can be modality for controlling diabetes mellitus.

1 INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a highly prevalent chronic disease with 366 million people in 2011 and approximately to increase by 51% reaching 522 million by 2030 (Whiting, Guariguata, Weil, & Shaw, 2011; WHO, 2006). The International Diabetes Federation (IDF) currently states that the 5 top countries with highest amount of diabetic patients are China, India, United States, Russia and Brazil. Diabetes caused 4.9 million people deaths in 2014. T2DM accounts for 90-95% of all diabetes cases in adults (Center for Disease Control and Prevention, 2011). Factor contributing to the high prevalence of T2DM include genetic predisposition, environmental and lifestyle risk factors (Neel J.V., 1962). Lifestyle factors such as physical activity and dietary (Hammam, 1992; Manson et al., 1991). Lifestyle interventions including exercise have been effective in offsetting T2DM complications and the progression from prediabetes to T2DM (Nathan, Turgeon, & Regan, 2007; Zanusso, Jimenez, Pugliese, Corigliano, & Balducci, 2010). Controlling blood glucose level is fundamental to the management of T2DM (American Diabetes Association, 2013; Waugh et al., 2007). Often pharmacological treatment alone is insufficient to achieve glycemic control, arrangement to dietary and physical activity is recommendations (Dyson et al., 2011; Knutson, Ryden, Mander, & Van Cauter, 2006) So far, interventions involving arrangement dietary and increased physical activity to bring about weight loss and delay the onset of diabetes (Li et al., 2008; Tuomilehto et al., 2001). Furthermore, mind-body interventions have been suggested to aid in regulating stress and controlling blood glucose. In this light, yoga has been suggested as a complementary and alternative medicine for treatment of T2DM. Yoga is traditional mind-body medicine 400 years ago in India and common did by religion of Hinduism (Sreedevi, Gopalakrishnan, Karimassery Ramaier, & Kamalamma, 2017). Yoga is found to be one the effective non pharmacological intervention in reducing stress with the result that glycemic control in T2DM (S. Singh, Malhotra, Singh, Madhu, & Tandon, 2004; Gordon et al.,
Yoga therapy includes physical postures (asanas), breathing exercise (pranayama), relaxation and meditation (Nagarathna et al., 2012) Yoga therapy is treatment non-invasive, free of side effect, and can be practiced by individuals with severe physical limitations. The purpose of this study was to systematically analyze and synthesize studies using yoga to controlling type 2 diabetes mellitus.

2 METHOD

A systematic review of studies involving yoga interventions for controlling diabetes mellitus was the method used in this study. To be included in this study, the article must meet the following criteria: (1) conducted between 2012 until 2018; (2) published in English Language; (3) used randomized control trial. First phase, identified studies meeting these criteria through databases searching: scopus, proquest, ScienceDirect, Google Scholar, Pubmed. Keywords used to identify studies meeting the criteria included “Yoga AND Diabetes” or “Yoga AND Diabetes mellitus” or “Yoga and diabetic”. Second phase, included preliminary distillation of the articles by eliminating duplicates and review/discussion/other articles. Third phase, comprising manuscript review of the remaining articles. Finally, the remaining article (n=9) satisfied the eligibility criteria.

3 RESULT

The completed data extraction process resulted in 9 studies, which satisfied the inclusion criteria. Table 1 summarizes the elements of the interventions, including research year, research design and sample size, age of the participants enrolled, intervention modality, intervention dosage, and silent findings. The reported interventions are arranged in ascending order by year publication.

4 DISCUSSION

The aim of this review was to look at studies published from 2012 until 2018 and examine whether yoga can be an alternative and complementary therapeutic approach for controlling diabetes mellitus. A total 9 studies met the inclusion criteria. The majority of the studies were conducted in India, that is as much as 7 studies, one studies in Thailand, and one studies in Hongkong.

Yoga originated in India, so it is natural that the majority studies would arise from that location. Should, conducting studies in countries where yoga is not rooted in more ethnic cultures and diversity can help in future program implementation. Such a study would be useful because the researcher tried to translate the trial-effectiveness trial.

The review looked at 9 studies of which 7 were randomized controlled designs, 1 studies used randomized controlled trial a pilot study, 1 studies used randomized controlled trial a feasibility study. Based on these studies, some conclusions can be made but one would need to consider the limitations. Besides the design, some other shortcomings that need to be kept in mind while interpreting the efficacy of yoga in controlling T2DM are the small sample sizes used in the studies, the lack of standardization of the yoga interventions, and varying dosages of the interventions. The sample sizes have generally been small with 7 studies having sample size more than 100. Power calculations and sample size justifications are generally missing from most of the reviewed studies. There have been no multicentric studies or largescale studies that have been done with this research problem. Future research should look at the possibility of conducting large-scale studies. The sample of studies included 1480 adults who consented to participate (mean age = 36 years). To advance yoga as a potential treatment for T2DM, sample sizes that can generate significant power are required.

Of the interventions, All studies used yoga asanas, 7 studies used pranayama, 6 studies used relaxation, and some studies used meditation, lectures on yogic life style, loosening exercise. The yoga interventions have been from a variety of schools of yoga and substantial numbers do not even identify any particular school. Yoga asanas are physical exercises with low physical impact that involve various body postures. These postures are ideally used for meditative practices. Yogic asanas relieve bodily strain and relax the mind. Some examples of asanas helpful in diabetes are padma asana (lotus pose), dhanura asana (bow pose), paschimotana asana (forwards seated bend pose), mayur asana (peacock pose), and shalab asana (locust pose). Pranayama is focused on controlling and inducing rhythmic breathing patterns to improve oxidative power and blood flow. Pranayama consists of 3 stages: puraka (inhaleation), kumbhaka (pausing or holding the breath), and rechaka (exhalation).
Relaxation have been shown to improve the mood with better glycemic control. Some examples of relaxation are shavasana pose, yoga nidra and A-U-M chanting. Yoga nidra is deep relaxation techniques to reduce tension and anxiety. Future randomized control trials testing various combination of these techniques would assist in determining the efficacy of various yoga practices as a treatment for T2DM.

The duration of the yoga intervention have various. Of the 9 studies, 5 studies with duration 3 months, 2 studies with duration 2 months, 1 studies with duration 6 months and 1 studies with duration 1 year. Because T2DM is a long-life disease, more interventions are needed that include long-term evaluation of yoga adherence and treatment effects. The duration of yoga is tailored to the physical activity needs of T2DM patients. Excessive activity in T2DM patients can produce negative effects such as hypoglycemia.

All studies measure glucose like as fasting blood glucose (FBG), fasting plasma glucose (FPG), Post prandial glucose level (PPBS), glycated hemoglobin (HbA1c). Four studies measure quality of life, 5 studies measure blood pressure, and some research measure fasting lipid, insulin, LDL, HDL, tryglycerides, depression. All studies showed significant decrease fasting glucose. Fasting blood glucose is a standardized, objective measure, which should be applied in future studies exploring this topic. From a prevention perspective, fasting blood glucose can be used to assess prediabetes. As a tertiary measure, fasting blood glucose measurements can monitor the treatment of diabetes.

5 CONCLUSIONS

Controlling blood glucose level is fundamental to the management of T2DM. One of the approaches to controlling diabetes is through yoga. A total of 9 studies from 2012 until 2018 looked at yoga and its efficacy in controlling blood glucose. Of the 6 studies that measured changes in blood glucose, 6 showed significant glucose. And 3 showed significant improve quality of life. Despite the limitations, had nonstandardized yoga intervention, had different outcomes and varying lengths, yoga is a promising modality for controlling diabetes mellitus.
Table 1. Summary of Yoga as an Alternative and Complementary Approach for Controlling Type 2 Diabetes Mellitus Done Between 2012-2018 (n=9)

<table>
<thead>
<tr>
<th>No</th>
<th>Year</th>
<th>Authors</th>
<th>Design and Sample</th>
<th>Age</th>
<th>Intervention Modality</th>
<th>Intervention Dosage</th>
<th>Outcomes</th>
<th>Silent Findings</th>
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<tbody>
<tr>
<td>1</td>
<td>2017</td>
<td>(K eerthi et al., 2017)</td>
<td>Randomized Control Trial, n=310, control group (n=62), prediabetes (n=124), diabetes (n=124)</td>
<td>18-45 years</td>
<td>Yoga included Sukshmavayama, suryanamaskar, asana, pranayama, meditation, Relaxation</td>
<td>45 minutes duration three times/week for 12 weeks</td>
<td>Biochemical measures (fasting insulin, fasting plasma glucose), anthropometric, Blood pressure, Indian diabetes risk score, Quality of life</td>
<td>improvement in QoL scale with p&lt;0.01 in group II and IV reduction in IDRS in group II (p&lt;0.05), p&lt;0.001 in Group III, IV, V significant difference (p&lt;0.001) in QoL scale an IDRS were found when study groups with standard treatment along with yoga therapy were compared to standard treatment alone.</td>
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<td>2</td>
<td>2013</td>
<td>(Hedge et al., 2011)</td>
<td>Randomized control trial n = 29 non-alcoholics and non-smokers</td>
<td>30-75 years</td>
<td>Asanas and pranayama</td>
<td>75-90 minutes each day interrupted by a two day weekend break for 3 months</td>
<td>anthropometric, Blood pressure, glucose, vitamin C and vitamin E, malondialdehyde, reduced glutathione and superox-ide dismutase (SOD) levels</td>
<td>Yoga intervention resulted in a significant decline in malondialdehyde (p &lt; 0.01), relative to the control group. In comparison with the control, there was a significant improvement in BMI, waist circumference, systolic blood pressure and fasting glucose levels at follow-up.</td>
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<td>3</td>
<td>2012</td>
<td>(Nagarathna et al., 2012)</td>
<td>Randomized control study n = 277 type 2 diabetics of both genders</td>
<td>Above 28 years</td>
<td>Yoga asanas, pranayama, meditation and lectures on yogic life style</td>
<td>One hour/day – 5 days/week for 12 weeks</td>
<td>Medication score, Biochemical measures included blood glucose, HbA1c and lipid profile</td>
<td>Intention to treat analysis showed better reduction (P&lt;0.05, Mann-Whitney test) in the dose of oral hypoglycemic medication required (Yoga - 12.8 %) (Yoga-12.3 %) and increase in HDL (Yoga7 %) in Yoga as compared to the control group; FBG reduced (7.2 %, P00.016) only in the Yoga group. There was significant reduction within groups (P&lt;0.01) in PPBG (Yoga-14.6 %, Control-9 %), HbA1c (Yoga-14.1 %, Control-0.5 %), Triglycerides (Yoga-15.4 %, Control16.3 %), VLDL (Yoga-21.5 %, Control-5.2 %) and total cholesterol</td>
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<tr>
<td>4</td>
<td>2015</td>
<td>(V. P. Singh, Khandelwal, &amp; Sherpa, 2015) India</td>
<td>Randomized control study n = 337</td>
<td>Above 20 years</td>
<td>Asanas and pranayama</td>
<td>15 second each pose and adding 15 second each pose every week for 6 months</td>
<td>Glycated hemoglobin (HbA1c), Fasting Blood glucose level (FBS), Post prandial glucose level (PPBS), Body mass index (BMI), Lipid Profile, State trait anxiety inventory (STAI), Beck depression inventory (BDI), Diabetes-Quality of Life (D-QOL), Exercise self efficacy and Blood Pressure (BP).</td>
<td>Yoga shows beneficial effects of clinical importance in glycemic control, reducing anxiety depression, reducing weight and BMI, and QoL.</td>
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<td>5</td>
<td>2014</td>
<td>(Youngwanichsetha, Phumdoung, &amp; Ingkathawornwong, 2014) Thailand</td>
<td>Randomized control trial N = 180</td>
<td>27-37 years</td>
<td>Asanas and pranayama</td>
<td>50 minutes, 5 times a week for 8 weeks</td>
<td>Fasting glucose, postprandial blood glucose, and hemoglobin A1c.</td>
<td>Combination yoga and mindfulness eating showed significantly reduced fasting plasma glucose, 2-h postprandial blood glucose, and glycosylated hemoglobin (HbA1c) in the intervention group (p = 0.05).</td>
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<td>6</td>
<td>2017</td>
<td>(Sreedevi, Unnikrishnan, Karimassery, &amp; Deepak, 2017) India</td>
<td>Randomized control trial (result) N=124</td>
<td>30-65 years</td>
<td>Suryanamaskar, relaxation, asanas</td>
<td>60 min, 2 days a week, 3 months</td>
<td>FPG, HbA1c, QOL, and pharmacological adherence</td>
<td>Yoga significant increases QoL in the enviromental domain. Peer support and yoga improved perceptions of QOL though its impact on scores was not significant due to a short period of study among women with poor glycemic control</td>
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<tr>
<td>7</td>
<td>2017</td>
<td>(Sreedevi, Gopalakrishnan, et al., 2017) India</td>
<td>Randomized control trial (feasibility study) N = 124</td>
<td>30-65 years</td>
<td>Suryanamaskara, relaxation, asanas</td>
<td>60 min, 2 days a week, 3 months</td>
<td>fasting plasma glucose, HbA1c, quality of life and pharmacological adherence</td>
<td>Yoga significant decrease glycosylated haemoglobin (HbA1c), diastolic blood pressure and hip circumference. Combination yoga and peer group support showed trend in decline of</td>
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<td>8</td>
<td>2014</td>
<td>(McDermott et al., 2014) India</td>
<td>Randomized controlled trial (pilot study) N=41</td>
<td>38-56 years</td>
<td>Didactis, Pranayama, Loosening exercises, asana, relaxation</td>
<td>75 minutes, attend at least three, and up to six, yoga classes per weeks over the eight weeks</td>
<td>Anthropometric, blood pressure, FBG, OGTT, fasting lipid and insulin, LDL</td>
<td>There were no between group differences in fasting blood glucose, postprandial blood glucose, insulin resistance or any other factors related to diabetes risk or psychological well-being. There were significant reductions in systolic and diastolic blood pressure, total cholesterol, anxiety, depression, negative affect and perceived stress in both the yoga intervention and walking control over the course of the study.</td>
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<td>9</td>
<td>2015</td>
<td>(Siu, Yu, Benzie, &amp; Woo, 2015) Hongkong</td>
<td>Randomized control trial N = 182</td>
<td>47-65 years</td>
<td>Asana, pranayama, relaxation</td>
<td>Each session lasted for 60-min consisting of 10-min of warm-up, 40-min of Hatha yoga practice, and 10-min of breathing exercise and relaxation</td>
<td>blood pressure, waist circumference, fasting glucose, triglycerides, and HDL-C, Center for Epidemiologic Studies Depression Scale (CES-D), the 12-item Short-form health survey (SF-12), and the International Physical Activity Questionnaire (IPAQ).</td>
<td>yoga exercise improves the cardiovascular risk factors including central obesity and blood pressure in middle-aged and older adults</td>
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REFERENCES


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