

Biopsychosocial Effects of Yoga in Patients with Diabetes: A Focused Review

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ABSTRACT

Background: Numerous studies have reported physiological and therapeutic effects of yoga in patients with diabetes., **Objective:** The objective of this paper is to update the yoga practitioners, physical therapists, diabetologists, physicians, and physiologists with the growing evidence on effects of yoga for diabetes through a systematic literature search., **Materials and methods:** Systematic review of studies in MEDLINE and CINAHL from 1951-2010 was conducted using search terms yoga OR yogic AND diabetes OR diabetic IN title OR abstract for English articles. Consensus was obtained after independent blinded search and overall findings were summarized., **Main findings:** Seventeen included articles were heterogenous and studied all categories of effects of yoga which were categorized into yogic techniques, biological effects, psychological effects and social effects. Most of the reported effects were short-term and smaller sample size populations., **Conclusion:** There was an overall beneficial effects for yoga among patients with diabetes. These beneficial effects were found not only to be physical, but also mental and social aspects of care. Further studies on psychological and social effects of yoga on diabetic patients are warranted.

Key words: yoga, glycemic control, biopsychosocial model, diabetes mellitus

INTRODUCTION

The ancient roots of Yoga began from India. The description of asanas and mudras were given as early as 3000 BC in the Rig Veda. In spite of its eastern origin, Yoga entered the western world with the magnificent contribution from Swami Vivekananda at Chicago, USA. Now, Yoga has been practised widely in western countries. Dunn¹ found that an estimated 7.4 million Americans practised Hatha Yoga and 64% of them did so for their

state of well-being alone., The art of Yoga terms 'the union of the mind, body and spirit' towards enlightenment or 'moksha.' Scientifically though, Yoga had its own series of milestones which were much later. It was Hummel² in the year 1951 whose article was the first to be published in MEDLINE where he described 'kundalini-yoga'.

Since then, Yoga has been an integral part of complementary and alternative medicine, and over the years, had been shown to be effective in a wide range of clinical conditions and chronic disorders, such as diabetes mellitus.³ Diabetes patients are likely to undergo yoga therapy at an odd's ratio of .56³ compared to their non-diabetic counterparts. Yoga is not only a well-established therapeutic tool but also an effective preventive tool against development of diabetes mellitus.⁴

The growing research evidence necessitated a summarizing of earlier findings for an in-depth understanding of the efficacy of yoga in diabetes. The objective of this paper is to

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review the articles from MEDLINE and to update the practitioners, patients and healthcare professional community on the effects of yoga in diabetes.

METHODS OF THE REVIEW

Independent search was conducted by two testers independently using search terms 'Yoga OR Pranayama AND diabetes OR diabetic IN title' in National Library of Medicine- MEDLINE (www.pubmed.com) website. The retrieved citations and articles were appraised and mutual consensus was obtained in presence of the third tester. The included articles were then grouped qualitatively under yoga asanas (techniques); systematic reviews and clinical trials (biological- clinical and laboratory measures, psychological, social effects).

RESULTS

Our search yielded 54 citations from 1951 to 2010. Of the 54 articles, we excluded non-English articles (22 papers), editorials (10 papers) and letters to editor (5 papers). Thus final number of included articles was 17.

MAIN FINDINGS

Therapeutic asanas and/or pranayamas studied in included studies on Yoga in type-2 DM:

Four studies⁵⁻⁸ detailed the description of used techniques with respective therapeutic dosage of prescription.

Kyizom *et al*⁵ used eleven techniques- bhastrika-pranayama (3-5min/day), kapal-bhati (10min/day), anulom-viloma (5-10min/day), bhramari (5 times a day), udgit-om uccharan (5 times a day), surya namaskar (3-7 turns of each pose-10 secs), tadasana (1/4min-1 min, adding 1/4min per week), trikona-asana (1/4 min-1min. adding 1/4min per week), paschimottasana (1/4 min-1min. adding 1/4min per week), bhujangasana (3-

7 turns of each pose-10 secs) and shavasana (2-5min, adding 1min per week).

Malhotra *et al*⁶ used the following fourteen asanas in the mentioned order; Surya Namaskar, Trikonasana, Tadasana, Sukhasana, Padmasana, Bhastrika Pranayama, Pashimottanasana, Ardhamatsyendrasana, Pawanmuktasana, Bhujangasana, Vajrasana, Dhanurasana and Shavasana.

Agarwal *et al*⁷ used health rejuvenating exercises (5 min), Surya namaskar/ parmashwar vandana (3 min), Paschimottanasana (3 min), Ardhamatsyana (3 min), Uttanpadmasana (3 min), Sarvangasana (3 min), Matsyasana (3 min), abdomen exercises (7 min), and on every alternate day either relaxation exercises (kayotsarga- 30 min) or preksha meditation including Pranayama and anupreksha for 30 min.

Bijlani *et al*⁸ used a combined intervention that consisted of asanas (postures), pranayama (breathing exercises), relaxation techniques, group support, individualized advice, lectures and films on the philosophy of yoga and the place of yoga in daily life, meditation, stress management, nutrition, and knowledge about the illness.

EFFECTS OF YOGA

Systematic reviews on effects of Yoga in type-2 DM:

Two studies^{9,10} were systematic reviews that described acceptable methodological criteria.

Aljasir *et al*⁹ did a recent systematic review that included five randomized controlled trials on a total 363 type-2 diabetes patients and found short-term efficacy of yoga therapy.

Innes and Vincent¹⁰ reviewed 25 eligible studies (15 uncontrolled trials, 6 non-randomized controlled trials and 4 randomized controlled trials) on the effects of yoga-based programs on physiologic and anthropometric risk profiles and related clinical outcomes in adults with type-2 DM. The authors found beneficial changes in

several risk indices, including glucose tolerance and insulin sensitivity, lipid profiles, anthropometric characteristics, blood pressure, oxidative stress, coagulation profiles, sympathetic activation and pulmonary function, as well as improvement in specific clinical outcomes.

Clinical commentaries on effects of Yoga in type-2 DM:

Sahay¹¹ did a comprehensive descriptive summary of their own studies in normal individuals and those with diabetes that assessed the role of yogic practices on glycaemic control, insulin kinetics, body composition exercise tolerance and various comorbidities like hypertension and dyslipidemia which were both short term and long-term. These studies showed the useful role of yoga in the control of diabetes mellitus through reductions in fasting and postprandial blood glucose levels. There was also a lowering of drug requirement and a significant reduction of the incidence of acute complications like infection and ketosis. There were significant changes in the insulin kinetics and those of counter-regulatory hormones like cortisol. There was a decrease in free fatty acids. There was an associated increase in lean body mass and decrease in body fat percentage. The number of insulin receptors was also increased. There was an improvement in insulin sensitivity and decline in insulin resistance reported by the author.

Clinical trials on effects of Yoga in type-2 DM:

BIOLOGICAL EFFECTS

Effect on clinical measures:

Kosuri and Sridhar¹² found reductions in body mass index (BMI) following a 40-day yoga camp on 35 type-2 diabetic subjects. Yang *et al*¹³ found that yoga group experienced improvements in body weight and blood pressure compared to educational group among 23 type-2 diabetic patients

following a 12-week intervention period. Cohen *et al*¹⁴ studied 26 patients with metabolic syndrome given either 15 yoga sessions of 90-minutes each for 10-weeks or a wait-list control group and they found significant reductions in blood pressure among yoga group patients. Malhotra *et al*¹⁶ studied 20 type-2 DM subjects on a 40-days yogasana regime that included 13 specific asanas and they found significant decrease in waist-hip ratio following the intervention.

Agarwal *et al*⁷ studied 154 type-2 diabetes subjects given either control intervention-standard medical care or unsupervised home exercises; or yoga-based lifestyle modification intervention for 3-months duration and they found significant improvements in BMI, W/H ratio, blood pressure and metformin, glipzide, insulin dose reduction in the yoga group. Singh *et al*¹⁵ found significant decreases in pulse rate, corrected Q-T interval on ECG, systolic and diastolic blood pressure following 40-day yoga therapy which included 13 well-known asanas. Jain *et al*¹⁶ found significant reduction in oral anti-hyperglycemic drug intake among 149 type-2 diabetic patients who underwent yoga therapy for 40-days.

EFFECT ON LABORATORY TEST MEASURES

Kyziom *et al*⁵ found the effects of Pranayama and yoga compared to conventional medical therapy alone on P300 (or P3 is a component of endogenous cerebral evoked response that indicates the higher cognitive functions of the brain) latency and amplitude on 60 type-2 diabetic patients. The authors found significant beneficial effects in the yoga group. Yang *et al*¹³ found that yoga group experienced improvements in plasma insulin and triglyceride levels compared to educational group among 23 type-2 diabetic patients following a 12-week intervention period.

Amita *et al*¹⁷ studied 41 middle-aged type-2 diabetic patients given either oral hypoglycaemic drugs alone or with yoga-nidra for 30 minutes daily upto 90 days and found

significant fall in both fasting and post-prandial plasma glucose levels in the combined yoga-nidra group. Skoro-Kondza *et al*¹⁸ studied 12-weeks of a twice-weekly 90-minute yoga class versus waiting list group among 59 type-2 DM patients and found insignificant decrease in levels of HbA_{1c} in the yoga group.

Malhotra *et al*⁶ studied 20 type-2 DM subjects on a 40-days yogasana regime that included 13 specific asanas and they found significant decrease in fasting glucose levels, post-prandial blood glucose levels and plasma insulin levels following the intervention. Bijlani *et al*⁸ studied the effects of 8-day yoga-based lifestyle intervention on metabolic markers in 98 subjects with diabetes and associated risk factors and found significantly lower fasting plasma glucose, serum total cholesterol, low-density lipoprotein (LDL) cholesterol, very-LDL cholesterol, the ratio of total cholesterol to high density lipoprotein (HDL) cholesterol, and total triglycerides with significantly higher levels of HDL cholesterol post-treatment.

Agarwal *et al*⁷ found significant improvements in glycemic control witnessed by HbA_{1c} levels, fasting blood glucose, lipid profile (reduction in total cholesterol, triglycerides, LDL and VLDL) without any significant changes in renal function measures. Singh *et al*¹⁵ studied 24 type-2 diabetic patients who were given supervised yoga therapy in addition to diet and drug regimen. The patients were given 13 yoga asanas for 30-40 min/day for 40 days. The authors found significant decreases in fasting and post-prandial blood glucose levels and glycosylated hemoglobin (Gly-Hb) post-treatment.

Malhotra *et al*¹⁹ found significant decreases in glucose levels and Gly-Hb similar to Singh *et al*.¹⁵ Malhotra *et al*¹⁹ found significant increases in median nerve conduction velocity in right and left hands of 24 type-2 diabetic patients who underwent yoga compared to standard medical care control group (20 subjects). Malhotra *et al*²⁰ found significant improvements pulmonary function parameters- FEV_1 , FVC, PEF, MVV and $FEV_1/FVC\%$ following 40-day yoga therapy that comprised of 13 asanas, on patients who

were similar in demographic characteristics to other two studies by Malhotra *et al*¹⁹ and Singh *et al*¹⁵.

Jain *et al*¹⁶ found significant reduction in blood hyperglycemia and oral hyperglycemia among 149 type-2 diabetic patients who underwent yoga therapy for 40-days.

PSYCHOLOGICAL EFFECTS

Kosuri and Sridhar¹² found reductions in anxiety scores and improvements in general well-being following a 40-day yoga camp on 35 type-2 diabetic subjects.

Yang *et al*¹³ found that yoga group experienced improvements in self-perceived exercise efficacy scores and reported higher levels of satisfaction compared to educational group among 23 type-2 diabetic patients following a 12-week intervention period. Cohen *et al*¹⁴ studied 26 patients with metabolic syndrome given either 15 yoga sessions of 90-minutes each for 10-weeks or a wait-list control group and they found increased attendance, improved adherence to home practice, highest satisfaction ratings, self-reported ease to perform asanas with a significant increase in perceived energy levels and overall well-being in the yoga group. Agarwal *et al*⁷ found significant improvements in satisfaction score, impact score, worry score, psychological assessment and self evaluation scores.

SOCIAL EFFECTS

Skoro-Kondza *et al*¹⁸ studied 12-weeks of a twice-weekly 90-minute yoga class versus waiting list group among 59 type-2 DM patients and they assessed program attendance, self-reported frequency of practice between taught sessions, diabetes-related quality of life and self-efficacy as outcome measures. The authors also assessed by interviews with patients, ethnographic observation of yoga classes and analysis of documents including minutes of meetings, correspondence and exercise plans.

Surprisingly though, the authors did not find any additional beneficial effects for the yoga group. Agarwal *et al*⁷ found positive improvements in quality of life scores in the yoga group compared to standard medical therapy group.

DISCUSSION

The mechanisms that operated behind *Yoga's* effectiveness at preventing and treating diabetes was due to its emphasis of a healthy diet and lifestyle as well as its ability to balance the endocrine system, massage and tone the abdominal organs, stimulate the nervous and circulatory systems, and reduce stress.²¹ Yoga could also stimulate the insulin producing cells in the pancreas and by its control over stress, can lower cortisol levels which were found to be responsible for increased blood sugar. Stress also had enormous deleterious effects on all bodily systems that are involved in most of the co-morbidities in diabetic patients.²² The effects of yoga on stress are well proven and widely known, thereby could have shown beneficial biological, psychological and social effects in diabetic patients.

Posadzki and Parekh²³ said yoga and physiotherapy are two similar professions in that they both depend on holistic multidimensionality and as part of a multidisciplinary care. The 'art' of yoga combined with the 'science' of physiotherapy if provided in an integrated collaborative manner, would for sure benefit diabetic patients.²⁴ Physiotherapists need to learn a lot from yoga on the biopsychosocial influence rather than being just 'physical'. The apt suggestion put forth by Nagendra²⁵ on misunderstanding Yoga as just only asanas or pranayamas is a fact beyond analysis, which was also confirmed in this review findings.

Malhotra *et al*⁶ suggested that yoga could be used as an effective adjunct to diet, drugs and exercise in patients with type-2 diabetes. Alexander *et al*²⁶ listed the contextual influences for beneficial effects of yoga therapy in diabetes patients such as the context of social environment, interpersonal

relationships, community characteristics and discrimination which affects a person's participation in regular physical activity.

The review findings need caution before interpretation and extrapolation due to lack of meta-analysis and most of the included studies reported short-term benefits for yoga only. There were no adverse effects reported as such. This review is different and is clinically sound since focusing on physical effects alone would not lead to a holistic management of a patient problem. This review hence is the first of its kind reporting on biopsychosocial effects *per se*.

To understand yoga, the following description from Yogapedia²⁷ adds value here; *Patanjali's writing also became the basis for a system referred to as "Ashtanga Yoga" ("Eight-Limbed Yoga"). This eight-limbed concept derived from the 29th Sutra of the 2nd book, and is a core characteristic of practically every Raja yoga variation taught today. The Eight Limbs are:*

Yama (The five "abstentions"): non-violence, non-lying, non-covetousness, non-sensuality, and non-possessiveness.

Niyama (The five "observances"): purity, contentment, austerity, study, and surrender to god.

Asana: Literally means "seat", and in Patanjali's Sutras refers to the seated position used for meditation.

Pranayama ("Suspending Breath"): Prâna, breath, "âyâma", to restrain or stop. Also it is interpreted as control of the life force.

Pratyahara ("Abstraction"): Withdrawal of the sense organs from external objects. Dharana ("Concentration"): Fixing the attention on a single object.

Dhyana ("Meditation"): Intense contemplation of the nature of the object of meditation. Samâdhi ("Liberation"): merging consciousness with the object of meditation.

The individual effects of each of the above mentioned components of yoga on diabetic patients thus warrant further investigations.

CONCLUSION

From the reviewed studies, it is evident of the biopsychosocial therapeutic beneficial effects of yoga in patients with diabetes mellitus. Further large-scale community-based intervention studies with longer follow-up are required to definitely establish positive evidence in favour of yoga as a therapy or as an adjunct in patients with diabetes mellitus.

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