Yoga Based Non-Pharmacological Approach in the Management of Glycemic Control and Associated Metabolic Disorders: A Review Article

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ABSTRACT

Yoga attempts to harmonize and balance the body, mind, and emotions. Yoga incorporates particular physical postures, breathing methods, relaxation, and meditation to help the body's mental and physical wellness. Based on data from several clinical trials, we briefly summarize the function of various yoga practices in the management of glycemic control and associated metabolic disorders in this review. We searched numerous databases and checked the bibliographies of pertinent review papers and all recognized publications to find qualified studies. Medication alone is not enough for most people to achieve glycemic control; various healthy habits, including nutrition, frequent physical exercise, and stress management, must also be addressed. Yoga practice has been shown to improve glycemic control by reducing stress and other self-care activities. Yoga as a mindfulness practice may be particularly beneficial to those with type 2 diabetes (T2DM).

Keywords: Yoga, mind, glycemic control, metabolic disorders.

INTRODUCTION

The term "yoga" is derived from the Sanskrit root "yuj," which means "union" or "yoke," and also to direct and concentrate one's attention. [1,2] Yoga is a mind-body intervention that incorporates particular physical postures (asanas), breathing methods (pranayama), relaxation, and meditation to promote mind-body union. [3,4] There are eight limbs of yoga: Yama (ethical behaviour), niyama (personal behaviour), asana (physical posture), pranayama (breath regulation), pratyahara (sensory inhibition), Dharana (concentration), dhyana (meditation), and samadhi, (integration). The yogic practice of these limbs leads to a greater ethical, spiritual, and healing condition.[5]

Yoga has been studied as a therapeutic tool to prevent or cure medical disorders such as stress, insomnia, anxiety, obesity, diabetes, glucose tolerance, oxidative stress, dyslipidemia, coronary heart disease, and neurodegenerative disease in recent years. [6–8] The development of numerous lifestyle problems, including diabetes, is associated with sedentary behaviours and improper food patterns. Diabetes risk and severity are also increased by psychological stress. Lack of physical exercise has been associated with a three-time increase in the risk of diabetes and a 2.4-time increase in the risk of coronary artery disease.[9] Medication, nutrition, and physical activity are all important aspects of diabetes control.[10] People have used many complementary and alternative activities, in
the prevention and treatment of diabetes.\textsuperscript{[11,12]} Yoga has been researched for its effectiveness in a variety of chronic conditions, including hypertension, chronic obstructive pulmonary disease, asthma, and diabetes.\textsuperscript{[13–15]} Previous research has suggested that Yoga can help to manage Insulin Resistance Syndrome, which is a group of risk factors for the development of T2DM, and has shown promising outcomes in terms of relieving symptoms, improving prognosis, and reducing complications.\textsuperscript{[13,15–19]} Other studies have shown that persistent physical exercise,\textsuperscript{[20–23]} a balanced diet,\textsuperscript{[21]} and active stress management,\textsuperscript{[24,25]} can either postpone or alleviate the progression of diabetes from a pre-diabetic condition.

**SOME OF THE BENEFICIAL EFFECTS OF YOGA PRACTICES ON GLYCEMIC CONTROL**

**Surya namaskar (sun salutation)**
It comprises a specific sequence of dynamic yoga poses. Surya namaskar stimulates insulin synthesis via brain signaling,\textsuperscript{[26]} it has a significant reduction in hip circumference and has a positive influence on glycemic outcomes.\textsuperscript{[27]}

**Yoga asana (yoga postures)**
When practicing yoga, the pancreas cells are revitalized by alternate abdominal contractions and relaxations. Yoga also improves blood supply to muscles and increases insulin receptor expression in muscles. It also increases glucose absorption by muscles\textsuperscript{[28]} and improves glucose utilization and fat redistribution in people with type 2 diabetes.\textsuperscript{[29]} Forward bend -It massages and pressurizes the pancreas, and stimulates insulin production. Backward bend -It has stimulating and energetic effects. Twisted poses - It squeezes the intestines to prevent colonic contents from becoming stagnant. Inversions - It boosts blood circulation.

**Shuddhi kriya (Cleansing processes)**

**Kapalbhati (frontal brain purification):**
The breathing techniques that involve exhaling forcefully and inhaling automatically. Exhalation creates abdominal pressure, which improves the effectiveness of β-cells of the pancreas. It promotes the synthesis of insulin and the regulation of blood glucose levels.

**Agnisar kriya (stimulating the digestive fire):**
The act of pulling the abdomen in (uddiyan bandha) and snapping it back and forth while holding one's breath. The 'vacuum' effect of this movement massages internal organs and improves blood flow to the region. It aids in the healthy functioning of the abdominal organs and boosts metabolism.\textsuperscript{[29]}

**Vaman dhauti (stomach cleansing with induced vomiting):**
It increases glucose absorption, lowers insulin resistance, and improves insulin action by lowering the body's circulating free fatty acid levels. It indicates a lower fasting and post-prandial blood glucose level.

**Shankhaprakshalana (intestine cleansing):**
It aids in the reduction of blood glucose levels and the rise of insulin production.\textsuperscript{[26]}

**Pranayama (regulated breathing):**
Pranayama, includes Anulom vilom, bhramari, Sheetal/Sitkari, chandrabhedan, Suryabhedan, and Bhastrika. It improves cerebral blood flow and oxygenation, as well as neuronal activity in brain centres such as the limbic regions, hypothalamus, and medulla. It also improves sympathovagal outflow.\textsuperscript{[30]}

**Anulom vilom (alternate nostril breathing):**
It helps with cardiorespiratory endurance, body fat percentage, and flexibility, all of which are important aspects of health-related fitness.\textsuperscript{[31]}
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**Bhramari** (humming bee breath)
It has a relaxing and soothing effect on the mind and is beneficial to both mental and physical health.\[^{32}\]

**Sheetali/Sitkari** (cooling breath)
It provides a cooling effect and helps to lower blood pressure.

**Chandra bhedan** (left nostril breathing)
It activates the parasympathetic nervous system.

**Surya bhedan** (right nostril breathing)
It stimulates the sympathetic nervous system and may be beneficial to diabetes.\[^{33}\]

**Bhastrika** (bellows breath)
It regulates the pineal, adrenaline, and pituitary glands and plays a crucial role in metabolism regulation.\[^{34}\]

**Bandha** (lock)
It includes constricting a specific area of the body and assisting in the re-direction of blood and the lymph to other parts of the body.

*Uddiyan bandha* (abdominal lock):
It causes the abdomen to constrict and produces negative pressure. The function of the pancreas enhances by the production of negative abdominal pressure.

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**Hasta mudras** (hand gestures)
*Apan* and *Gyan mudra* help to relieve stress and induce deep relaxation. *Linga mudra, Prana mudra,* and *Surya mudra* increase metabolic rates, help weight reduction, and lower blood glucose levels.

**Dhyan** (meditation)
It offers psychological benefits including quicker stimulus reactions and being less prone to various types of stress,\[^{35}\]* anxiety lowering, and blood pressure regulation.\[^{36}\]* It also lowers blood glucose levels. During meditation, focus on the *Manipur chakra* (solar plexus) and visualize the pancreas.

**Mindfulness**
In diabetes and coronary heart disease persons, it promotes sleep quality, relaxation, and more receptive attitudes toward sickness and the illness experience.\[^{37}\]

*“Aum” chanting*
Within minutes of practice, it has brain-stabilizing effects, eliminates negative thoughts, boosts energy, and enhances the mind and body relaxation.\[^{38}\]* In the supine position, chanting induces an integrated relaxation response.\[^{39}\]

**Yoga Nidra** (yogic relaxation)
It aids in the improvement of symptom scores, as well as the lowering of fasting and postprandial blood glucose levels.\[^{40}\]

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**BENEFITS OF YOGA PRACTICE IN TYPE 2 DIABETES; BP (BLOOD PRESSURE); HPA (HYPOTHALAMIC-PITUITARY-ADRENAL); GH (GROWTH HORMONE)**

*Yoga practice*

- **Behavioral changes**: It increases physical activity and adherence to diet and medicines.
- **Psychological changes**: It increases quality of life, and mood, and decreases stress.

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Physiological changes: - It improves endothelial function, pancreas regeneration, and exercise tolerance by lowering body weight, heart rate, blood pressure, and lipid profile. It has Immunomodulation by Changes in gene expression, inflammatory response, and cellular immunity. It affects the Sympatho-adrenal and HPA axis by elevating Melatonin and endorphin levels while decreasing GH, cortisol, prolactin, and adrenaline levels. It increases insulin secretion and decreases Insulin resistance. It also boosts cardiac autonomic function, nerve conduction, coagulation profile, and mental stability. Yoga's overall impact is to prevent and control diabetes, as well as to regulate body weight, blood pressure, and lipid profile, as well as to prevent cardiovascular events and diabetic complications.

CONCLUSIONS

Yoga therapy helps with both health and sickness. According to the most recent scientific data, yoga-based lifestyle changes may have a role in the treatment of type 2 diabetes and its risk factors. Psycho-neuro-endocrine and immune systems are thought to have a comprehensive impact on diabetes management. Parasympathetic activation and the anti-stress processes that accompany it enhance patients' overall metabolic and psychological profiles, improve glucose tolerance and boost insulin sensitivity and lipid metabolism. Yoga techniques such as cleansing, pranayama, asanas, meditation, mudras, bandha, mindfulness, and relaxation have been shown to lower blood glucose levels and assist in the treatment of comorbid medical conditions associated with T2DM, with considerable good clinical effects. However, well-designed RCTs are required to assess the long-term effectiveness of yoga intervention not just for the risk of T2DM but also for other metabolic syndromes and cardiovascular diseases.

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