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THE IMPACT OF YOGA AND MEDITATION ON BLOOD SUGAR REGULATION AND DIABETES PREVENTION

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ABSTRACT

Yoga is a means of balancing and harmonizing the body, mind, and emotions. Yoga practice is useful in the management of various lifestyle diseases, including type 2 diabetes. Psycho-neuro-endocrine and immune mechanisms are involved in the beneficial effects of yoga on diabetes. Incorporation of yoga practice in daily life helps to attain glycaemic control and reduces the risk of complications in people with diabetes. In this review, we briefly describe the role of various yoga practices in the management of diabetes based on evidence from various clinical studies.

KEYWORDS: Yoga, Diabetes mellitus, Yoga asana, Pranayama, Meditation.

INTRODUCTION

Diabetes is a growing global health challenge, with type 2 diabetes (T2D) accounting for more than 90% of all cases. Lifestyle modifications, including diet and exercise, play a crucial role in preventing and managing the disease. In recent years, research has increasingly focused on alternative therapies such as yoga and meditation for their potential to regulate blood sugar levels and prevent diabetes. This article explores the scientific evidence supporting the role of yoga and meditation in blood sugar regulation and diabetes prevention.

Understanding the link between stress, Blood sugar and Diabetes

Chronic stress and an unhealthy lifestyle contribute significantly to insulin resistance, a key factor in the development of diabetes. When stressed, the body releases cortisol and adrenaline, which can lead to increased blood glucose levels. Long-term stress also promotes inflammation and metabolic dysfunction, exacerbating diabetes risk. Yoga and meditation are known to reduce stress and enhance overall well-being, which may positively influence blood sugar regulation.

Scientific research on Yoga and Blood sugar regulation

Several studies have investigated how yoga affects blood glucose levels, insulin sensitivity, and diabetes management:

1. **Improved Insulin Sensitivity and Blood Sugar Control**

- A 2020 meta-analysis published in Diabetes & Metabolic Syndrome found that yoga interventions led to significant reductions in fasting blood sugar, postprandial blood sugar, and HbA1c levels (a marker of long-term blood sugar control).
- Another study published in The Journal of Diabetes Research reported that individuals with T2D practicing yoga for three months experienced improved insulin sensitivity and reduced medication dependency.

2. **Reduction in Inflammation and Oxidative Stress**

- Chronic inflammation and oxidative stress are key drivers of insulin resistance. Research in The Indian Journal of Endocrinology and Metabolism highlighted that yoga reduces inflammatory markers such as C-reactive protein (CRP) and interleukin-6 (IL-6), thereby lowering diabetes risk.

3. **Weight Management and Metabolism Enhancement**

- Obesity is a major risk factor for diabetes. A study in Obesity Reviews found that regular yoga practice led to reductions in body mass index (BMI), waist circumference, and visceral fat—all of which are linked to improved glucose metabolism.

The role of meditation in blood sugar regulation

Meditation, particularly mindfulness-based stress reduction (MBSR) and focused breathing techniques, has been studied for its impact on diabetes prevention and management.

1. **Lowering Cortisol and Reducing Blood Sugar Spikes**

- A study published in Psychoneuroendocrinology showed that mindfulness meditation significantly lowered cortisol levels, which in turn helped stabilize blood sugar levels.
- Another study in Diabetes Care found that individuals who practiced mindfulness-based interventions had better glucose control compared to those who did not engage in meditation.

2. **Enhanced parasympathetic nervous system activity**

- Meditation activates the parasympathetic nervous system, promoting relaxation and reducing the fight-or-flight response. This helps regulate glucose metabolism by lowering insulin resistance and promoting balanced blood sugar levels.

3. **Emotional and Behavioral benefits**

- Emotional eating and stress-related food cravings are common contributors to diabetes. Mindfulness meditation has been shown to improve emotional regulation, leading to healthier dietary choices and better adherence to lifestyle modifications.

Some Yoga Practices Beneficial for the Management of Type 2 Diabetes Mellitus

Yoga technique	**Approximate duration and remarks**
Cleansing practices: *shuddhi kriya*	
Kapalbhati (Frontal brain purification)	5 rounds, 120 strokes
Agnisar kriya (Stimulating the digestive fire)	5 rounds
Vaman dhauti (Stomach cleansing)	Once a week
Full shankhaprakshalana (Intestine cleansing)	Once a year
Laghu shankhaprakshalana (Short cleansing)	Every 40 days
Preparatory practices/warming up	5–10 minutes
Surya namaskar	Slow speed, 3–7 rounds according to an individual's capacity
Yoga postures: *Asanas*	
Standing postures	
Trikonasan (Triangle pose)	Recommended to hold the final pose for 15 seconds, gradually increasing the duration up to 1 minute
Tadasan (Palm tree pose)	
Tiryak tadasan (Bent palm tree pose)	
Veerasan (Warrior pose)	
Seated poses	
Vakrasan (Spinal twist)	Recommended to hold the final pose for 15 seconds, gradually increasing the duration up to 1

	minute
Ardhamatsyendrasan (Seated spinal twist)	
Mandukasan (Frog pose)	
Ushtrasan (Camel pose)	
Paschimottanasan (Seated forward bend)	
Yoga mudra (Forward bend)	
Prone poses	
Bhujangasan (Cobra pose)	Recommended to hold the final pose for 15 seconds, gradually increasing the duration up to 1 minute
Dhanurasan (Bow pose)	
Naukasan (Boat pose)	
Makarasan (Crocodile pose)	Relaxation pose: 2–5 minutes as needed
Supine poses	
Pavanmuktasan (Wind releasing pose)	Recommended to hold the final pose for 15 seconds, gradually increasing the duration up to 1 minute
Supta vajrasana (Supine thunderbolt pose)	
Setubandhasan (Bridge pose)	
Matsyasan (Fish pose)	
Shavasan (Corpse pose)	Relaxation pose: 2–5 minutes as needed
Inversions	
Sarvangasan (Shoulder stand)	Hold the final pose for 15 seconds, gradually increasing the duration up to 1 minute
Halasan (Plough pose)	
Regulated breathing practices: *pranayama*	
Anulom vilom (Alternate nostril breathing)	5–10 minutes
Chandra bhedan (Left nostril breathing)	5 minutes
Surya bhedan (Right nostril breathing)	5 minutes
Bhastrika (Bellows breath)	3–5 minutes
Bhramari (Humming bee breath)	5 rounds
Sheetali/Sitkari (Cooling breath)	3–5 minutes
Lock: *bandha*	
Uddiyan bandha (Abdominal lock)	5 rounds
Hand gestures: *mudras*	
Linga mudra, surya mudra, prana mudra, apan mudra, gyan mudra	15–45 minutes
Meditation	10 minutes or more
Meditation on *manipur chakra* (Solar plexus)	10 minutes
"Aum" chanting	5 minutes
Yogic relaxation: *yoga nidra*	30 minutes

Some of the Beneficial Effects of Yoga Practices on Type 2 Diabetes Mellitus

Yoga practice	Effects
Surya namaskar sun salutation	Stimulates insulin production through brain signalling
A series of dynamic yoga postures in a specific sequence	Significantly decreases hip circumference, exerting beneficial effects on glycaemic outcomes
Yoga asana (Yoga postures)	Rejuvenates of pancreatic cells through the alternating abdominal contractions and
	relaxations involved in yoga practice
	Improves blood supply to muscles
	Enhances insulin receptor expression in the muscles, causing increased glucose
	uptake by muscles
	Has positive effects on glucose utilization and fat redistribution in type 2 diabetes
Forward bend	Massages and pressurizes the pancreas, stimulating insulin secretion
Backward bend	Exerts stimulating and energizing effects
Twisted poses	Squeeze the intestines to prevent stagnation of colonic contents
Inversions	Improve blood circulation
Shuddhi kriya cleansing processes	
Kapalbhati (Frontal brain purification): breathing technique with forceful exhalations and automatic inhalations	Abdominal pressure created during exhalation improves the efficiency of β-cells of the pancreas
	Helps in the production of insulin and controlling glucose levels in the blood
Agnisar kriya (Stimulating the digestive fire): pulling the abdomen in (*Uddiyan bandha*) and snapping it backwards and forwards while holding one's breath	The ‘vacuum’ effect of this action massages the internal organs and increase blood flow to the area
	Boosts metabolism and facilitates proper functioning of the abdominal organs
Vaman dhauti (Stomach cleansing with induced vomiting)	Increases glucose uptake, minimizes insulin resistance, and promotes the function of insulin by reducing levels of circulating free fatty acids in the body
	Marked reduction in fasting and post-prandial blood sugar levels
Shankhaprakshalana (Intestine cleansing)	Significantly reduces blood glucose levels
	Increases insulin production
Pranayama (Regulated breathing)	
Slow *pranayama*, *anulom vilom*, *chandrabhedan*, *sitkari*, and *bhramari*	Augment cerebral blood flow and oxygenation, improving neuronal activities in the brain centres, including those present in the limbic areas, hypothalamus, and medulla, and improve sympathovagal outflow

Anulom vilom (Alternate nostril breathing)	Improves components of health-related fitness, i.e., cardiorespiratory endurance, flexibility, and body fat percentage
Bhramari (Humming bee breath)	Soothing and calming effect on the mind, improves mental and physical health
Sheetali/Sitkari (Cooling breath)	Lowers blood pressure, cooling effect
Chandra bhedan (Left nostril breathing)	Parasympathetic stimulation
Surya bhedan (Right nostril breathing)	Sympathetic stimulating effect; may be recommended in people with diabetes
Bhastrika (Bellows breath)	Regulation of pineal, pituitary, and adrenaline glands, important role in the regulation of metabolism
Bandha (Lock)	
Constricts a certain part of the body	Re-directs the flow of blood and lymph to other body parts
Uddiyan bandha (Abdominal lock): creation of negative pressure in abdomen and contraction of abdomen	Negative pressure created in the abdominal cavity may improve pancreatic function
Hasta mudras (Hand gestures)	
Apan mudra, gyan mudra	Promote deep relaxation and eliminate stress
Linga mudra, surya mudra, prana mudra	Boost metabolic rates, promote weight loss, and reduce sugar levels
Dhyan (Meditation)	Beneficial psychological effects, such as faster reactions to stimuli and being less prone to various forms of stress, anxiety reduction, and blood pressure control
Meditation on the manipur *chakra* (Solar plexus), visualization of pancreas during meditation	Positive effects on sugar levels
Mindfulness	Better sleep, greater relaxation, more accepting approaches to illness and the illness experience in people with diabetes and coronary heart disease
"*Aum*" chanting	Stabilizes the brain, removes negative thoughts, increases energy, improves mind and body relaxation within minutes of practice
	Chanting in the supine posture produces an integrated relaxation response
Yoga nidra (Yogic relaxation)	Improved symptom score, reduction of fasting blood glucose and postprandial blood glucose levels

CONCLUSION

The growing body of scientific research suggests that yoga and meditation play a significant role in blood sugar regulation and diabetes prevention. By improving insulin sensitivity, reducing stress and inflammation, promoting weight management, and enhancing emotional

well-being, these mind-body practices offer a holistic approach to diabetes care. Incorporating yoga and meditation into daily routines may serve as a complementary strategy alongside conventional treatments to reduce the risk of diabetes and improve overall metabolic health.

DISCUSSION

Further large-scale clinical trials are needed to establish standardized yoga and meditation protocols for diabetes prevention and management. However, the current evidence strongly supports their inclusion in lifestyle interventions for at-risk individuals and those already living with diabetes.

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