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**R Poornima**

Vels Institute of Science and Technology, Pallavaram, Chennai, Tamil Nadu, India

**Dr. S Natarajan**

Vels Institute of Science and Technology, Pallavaram, Chennai, Tamil Nadu, India

**Dr. CV Jayanthi**

Vels Institute of Science and Technology, Pallavaram, Chennai, Tamil Nadu, India

## Impact of selected yoga practices on fasting blood sugar and BMI among pre-diabetic male adults

**R Poornima, Dr. S Natarajan and Dr. CV Jayanthi**

### Abstract

Yoga is a holistic practice that involves physical movements, breathing techniques, meditation, and relaxation methods. It is an effective therapeutic approach for people with pre-diabetes. A study was conducted to evaluate the effectiveness of a 20-week yogic protocol that included Asana, Pranayama, and Relaxation. The study aimed to enhance overall physical function and regulate fasting blood sugar levels, and BMI among male adults.

Forty participants were enlisted and randomly divided into two groups - the Yoga group (YG) and the Control group (CG). The Yoga group attended sessions five days a week for 20 weeks. After the intervention, significant reductions in fasting blood sugar levels and Body Mass Index were observed due to the consistent practice of yoga by the Yoga group.

**Keywords:** Yoga, pre-diabetes, fasting blood sugar, BMI

### Introduction

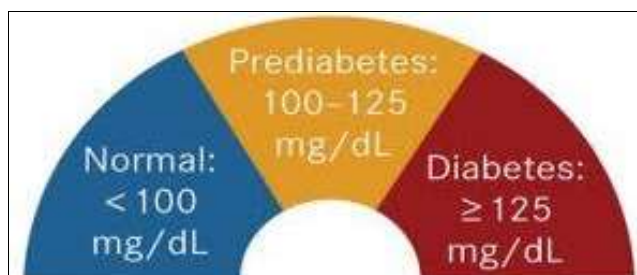
Prediabetes is a common health condition where blood sugar levels are higher than normal but not high enough to be classified as Type 2 diabetes.

In India, according to the National Urban Diabetes Survey, about 14% of the population suffers from prediabetes. Identifying these individuals early on is essential so that appropriate therapeutic interventions can be made.

It is a sad reality that more than 80% of people exhibiting prediabetes symptoms are unaware of their condition. If you are one of them, it is essential to be cautious. Being prediabetic puts you at higher risk of developing Type 2 diabetes, as well as heart disease and stroke if left untreated.

If you have prediabetes, it's important to know that your pancreas still produces insulin in response to carbohydrates. However, the problem lies in the fact that your body's cells don't respond to the insulin as efficiently as they should, which leads to high blood sugar levels. This condition is called insulin resistance.

Prediabetes is a condition that can be managed and potentially reversed, according to the National Institutes of Health (NIH). Treatment may involve lifestyle changes, such as diet and exercise, as well as medication. The Mayo Clinic warns that if you don't make necessary lifestyle adjustments after recognizing prediabetes symptoms, you may develop Type 2 diabetes within ten years.



**Corresponding Author:**

**R Poornima**

Vels Institute of Science and Technology, Pallavaram, Chennai, Tamil Nadu, India

**Fasting Blood Glucose Test**

Measures the amount of sugar in your blood after fasting overnight

**Normal:** less than 100 mg/dL

**Prediabetes:** 100- 125 mg/dL

**Diabetes:** 126 mg/dL or higher

(Ref: American Diabetes Association. Classification and diagnosis of diabetes. *Diabetes Care*. 2016;39(1):S14–S20, table 2.1)

**In a Nutshell,**

As per the National Urban Diabetes Survey, the incidence of prediabetes in India is estimated to be 14%.

The sad reality is that over 80% of people with prediabetes symptoms are unaware of their condition. Therefore, it is important to watch for any symptoms.

According to the National Institutes of Health (NIH), prediabetes is a condition that can be managed and potentially reversed.

Prediabetes does not imply that you will develop diabetes. But it's almost like a warning of what's to come. Prediabetes increases the risk of Type 2 diabetes by 5 to 15 times compared to people with normal blood sugar levels.

It is important to note that the chances of developing diabetes increase if healthy changes are not made to one's diet or exercise habits. Prediabetes in adults often goes unnoticed as there are usually no symptoms or the signs are very mild. Nevertheless, there may be some warning signals that occur from time to time.

Prediabetes can cause skin discoloration, usually in areas with folds or creases, such as the neck, armpits, elbows, knuckles, and knees. The affected skin may become thick and velvety.

If you have a family history of diabetes, it is important to visit your doctor if you experience any of the following symptoms:

- Extreme thirst
- Frequent urination, especially at night
- Extreme fatigue
- Blurred vision
- Sores or wounds that don't heal
- Unexplained weight loss.

Remember that early detection and treatment can help prevent serious complications associated with diabetes.

These symptoms may indicate that prediabetes has progressed to Type 2 diabetes.

Body mass index (BMI) is a measure of body fat based on a person's weight and height. It is commonly used to screen for weight categories that may lead to health problems. BMI calculations are simple and can be used as an initial screening tool, but they do have some limitations and should not be used as a sole indicator of an individual's health.

Research has shown that individuals with a high BMI are at increased risk of developing pre-diabetes compared to individuals with a healthy BMI. This is because excess body fat can cause insulin resistance, making it more difficult for the body to regulate blood sugar levels. Maintaining a healthy BMI through regular exercise and healthy eating can help reduce the risk of pre-diabetes and other conditions associated with excess body fat. It's important to note that pre-diabetes risk is affected by factors beyond BMI, including age, genetics, and lifestyle.

**Methods**

A comprehensive method is provided below, detailing the

individuals involved, variables studied, training methodologies employed, and statistical techniques used. The recruitment strategy encompassed marketing efforts and public announcements across various yoga therapy clinics. Before data collection, individuals meeting the inclusion criteria provided informed consent. The study enrolled a total of 40 pre-diabetic male participants, categorized into two equal groups: the experimental group, and the control group. Measurement of Fasting Blood Sugar and Body Mass Index levels was conducted using standard measurement methods and blood sampling procedures. The Experimental group engaged in a 20-week program, involving instruction and practice of selected yoga practices, such as:

**Asana:** Surya namaskar, thoppukarnam

**Sitting:** Vakrasan, paschimottanasan

**Prone:** Dhanurasana

**Supine:** Pavanamuktasan, hasta-padasanchalanasan

**Pranayam:** Dirgha pranayama, nadi shodhana, bhramari

**Mudra:** Apana mudra, prana mudra

**Bandha:** Uddiyan bandh, agnisaar kriya

**Dhyana:** Nadaanusandhana, Pranava chanting meditation

**Relaxation:** IRT, QRT, DRT, Yoga Nidra

Asanas or the physical postures included here are a set of physical practices that help in regulating hormonal levels, boosting circulation, and reducing stress and tension from the body while stimulating metabolism.

Pranayam or breathing techniques are practices that focus on regulating one's breathing pattern to reduce stress and improve overall well-being. These techniques involve deep, diaphragmatic breathing, which can help activate the body's relaxation response and reduce feelings of anxiety and tension. You can practice restorative breathing techniques in a variety of settings, including meditation, yoga, and mindfulness exercises. They are simple yet effective tools that can be used to promote a sense of calm and balance in your daily life. Breathing practices such as dirgha pranayama, nadi shodhana, and bhramari can be incorporated in your daily routine to help you feel relaxed and rejuvenated.

In the practice of yoga and meditation, hand gestures known as mudras are used to direct the flow of energy within the body and facilitate healing. Each mudra holds a unique significance and is thought to aid in balancing the chakras and promoting overall mental and physical well-being. For prediabetic male adults, practicing Apana mudra and prana mudra is beneficial.

Affirmations are positive statements that aim to reprogram the subconscious mind, replacing negative and limiting beliefs with empowering and uplifting ones.

- My metabolism is strong and healthy
- The circulations in my body are consistent and functioning properly throughout.
- I express gratitude to my body for operating consistently and healthily.

Meditation is a technique that involves training the mind to enter a state of relaxation, calmness, and inner peace. Regular meditation can help reduce stress, improve concentration, enhance emotional well-being, and deepen self-awareness. The practice of Pranava chanting and Nadaanusandhana can help achieve these benefits.

Relaxation techniques refer to methods used to attain a state of calmness and tranquillity by reducing physical and mental tension. These techniques may include deep breathing

exercises, relaxation of different parts of the body, visualization, and meditation. The primary goal of deep relaxation is to alleviate stress, promote better sleep, and enhance overall well-being. One such practice of deep relaxation technique is yoga nidra.

The data gathered from the experimental and control groups

before and after the experiment, focusing on Fasting Blood Sugar, and Body Mass Index, were evaluated to see if there were any statistically significant differences. This investigation made use of the F-ratio analysis of variance.

**Statistical Analysis**

**Table 1:** Analysis of co-variance of the pre test and test means of the control group and experimental group in fasting blood glucose test

Group	Control	Experimental	Source of variance	Sum of squares	df	Mean square	'F' Ratio
Pre-Test Mean	110.10	118.40	Between	688.900	1	688.900	17.46*
SD	7.67	4.47	Within	1498.600	38	39.437	
Post-test Mean	109.15	87.80	Between	4558.225	1	4558.225	90.13*
SD	8.22	5.78	Within	1921.750	38	50.572	
Adjusted Post-test mean	114.25	98.48	Between	3897.563	1	3897.563	74.26*
			Within	1852.047	38	47.504	

S – Significant

From the above table, the pre-test mean score of the control group is 110.10, experimental group is 118.40. Therefore, it is evident that the obtained 'F' value is 17.46 for the Pre-Test mean score. Therefore, the framed research hypothesis is accepted. It is inferred that there is a significant difference between the pre-test means of the control group levels of the Fasting Blood Glucose test. Further, the Post-test mean score of the control group is 109.15, experimental group is 87.80. Therefore, it is evident that the obtained 'F' value is 90.13 for

the Post-Test mean score. Therefore, the framed research hypothesis is accepted. Further, the above table taking into consideration of the adjusted post-test mean score of the control group is 114.25, experimental group is 98.48. Therefore, it is evident that the obtained 'F' value is 74.26. Therefore, the framed research hypothesis is accepted. It is inferred that there is a significant difference between the adjusted post-test means of the yoga practices on levels of Fasting Blood Glucose test.

**Table 2:** Analysis of co-variance of the pre test and post test means of the control group and experimental group in body mass index

Group	Control	Experimental	Source of variance	Sum of squares	df	Mean square	'F' Ratio
Pre Test Mean	27.77	27.74	Between	0.012	1	0.012	0.025 NS
SD	0.67	0.71	Within	18.411	38	0.484	
Post test Mean	27.83	24.11	Between	138.384	1	138.384	29.6*
SD	0.70	0.66	Within	17.731	38	0.467	
Adjusted Post test mean	27.75	25.97	Between	142.065	1	142.065	32.7*
			Within	19.534	38	0.528	

S – Significant

NS – Not Significant

The above table result reveals that the pre-test mean score of the control group is 27.77, the experimental group is 27.74. Therefore, it is observed that the obtained 'F' value is 0.025 for the Pre-Test mean score. Therefore, the framed research hypothesis is rejected. It is inferred that there is no significant difference between the pre-test means of the Body Mass Index. Also, the Post-test mean score on the control group is 27.83, experimental group is 24.11. Therefore, it is evident that the obtained 'F' value is 29.6 for the Post-Test mean score. Therefore, the framed research hypothesis is accepted. Further, the above table taking into consideration the adjusted post-test mean score of the control group is 27.75, experimental group is 25.97. Therefore, it is evident that the obtained 'F' value is 32.7. Therefore, the framed research hypothesis is accepted. It is inferred that there is a significant difference between the adjusted post-test means of the Body Mass Index.

**Conclusion**

In conclusion, the findings of this research underscore the profound and positive impact that selected yoga practices can have on the health parameters of pre-diabetic male adults, specifically fasting blood sugar levels and body mass index (BMI). Through a comprehensive exploration of the effects of targeted yoga interventions, it has become evident that incorporating yoga into the lifestyle of individuals with pre-diabetes can yield meaningful improvements in metabolic

health.

The observed reduction in fasting blood sugar levels suggests that yoga practices may contribute to enhanced glucose regulation, potentially mitigating the progression to full-blown diabetes. Additionally, the favorable changes in body mass index highlight the potential role of yoga in promoting weight management, a crucial aspect in the overall management of pre-diabetes.

The holistic nature of yoga, encompassing physical postures, breathing exercises, and mindfulness techniques, may contribute synergistically to the observed benefits. By addressing both physical and psychological aspects, yoga appears to offer a comprehensive approach to improving health outcomes in pre-diabetic individuals.

These findings not only contribute to the growing body of evidence supporting the therapeutic potential of yoga but also emphasize the importance of lifestyle interventions in the management of pre-diabetes. Integrating yoga into conventional strategies for pre-diabetes may provide a viable and accessible means for individuals to actively participate in their health and well-being.

It is essential to acknowledge the limitations of this study, such as the relatively small sample size and the need for longer-term follow-ups to assess the sustainability of the observed improvements. Future research endeavors should delve deeper into the specific mechanisms through which yoga exerts its beneficial effects and explore the optimal

frequency, duration, and types of yoga practices for individuals with pre-diabetes.

In conclusion, the positive outcomes observed in this research support the inclusion of selected yoga practices as an adjunctive therapeutic approach in the management of pre-diabetes, offering a promising avenue for improving metabolic health and potentially preventing the progression to diabetes in male adults.

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