

## ORIGINAL RESEARCH ARTICLE

# Yoga and Diabetes: Unveiling the Therapeutic Potential of Kumbhaka Practices in a 60-day Intervention Study

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### ABSTRACT

**Background:** The 21<sup>st</sup> century has marked an increase in global health challenges due to lifestyle transformations associated with globalization and modernization. Diseases such as mental stress, diabetes, hypertension, and cardiovascular ailments have become prominent, emphasizing the need for effective interventions.

**Objective:** The objective of the study was to assess the potential therapeutic benefits of Kumbhaka, a key component of yoga, in managing type 2 diabetes.

**Methods:** A 60-day intervention study was conducted, involving three groups: Group I received allopathic medicine, Group II practiced Kumbhaka exclusively, and Group III served as the control. Various biochemical parameters, including fasting plasma glucose, 2-h postprandial glucose, and hemoglobin A1c, were monitored.

**Results:** Both experimental groups (Group I and II) demonstrated significant reductions in the monitored biochemical parameters. Notably, Group II exhibited better outcomes compared to Group I. In addition, improvements in energy levels and blood pressure were observed in the experimental groups.

**Conclusion:** Kumbhaka therapy demonstrated promising results in managing type 2 diabetes, suggesting its potential as an alternative or complementary approach. Further comprehensive studies with larger sample sizes are recommended for validation and broader applicability.

## 1. INTRODUCTION

The 21<sup>st</sup> century has witnessed a surge in global epidemics, notably fueled by lifestyle changes accompanying the processes of globalization and modernization. Among the escalating health challenges, mental stress, diabetes, hypertension, and cardiovascular diseases stand out as rapidly increasing concerns. The intricate relationship between these modern ailments and the evolving global landscape underscores the urgency of effective interventions.<sup>[1]</sup>

Yoga, an ancient practice rooted in India but introduced to the Western world in the 19<sup>th</sup> century, has garnered considerable attention as a therapeutic tool in addressing these contemporary health issues. In recent decades, extensive research has delved into the therapeutic benefits of

yoga in combating mental stress, obesity, diabetes, hypertension, coronary heart disease, and chronic obstructive lung disease. The multifaceted approach of yoga, encompassing physical postures (*asanas*), breath control (*pranayama*), concentration (*Dharana*), meditation (*Dhyana*), and spiritual absorption (*Samadhi*), has been a focal point of investigation.<sup>[2-5]</sup>

India, often referred to as the diabetes capital of the world, has been at the forefront of studying the impact of yoga on diabetes management. With the highest number of diabetes cases globally, India's exploration of yoga as a complementary approach to conventional pharmacotherapy has yielded promising results. Notably, the practice of yoga asanas and pranayama has demonstrated its efficacy in controlling type 2 diabetes, with studies reporting significant reductions in fasting and postprandial blood glucose levels and acetylated hemoglobin.<sup>[6-8]</sup>

A study conducted by a team of yoga experts revealed that 1 h of daily yoga practice for 3 months led to a substantial decrease in

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blood glucose levels and acetylated hemoglobin. Similarly, another investigation documented a decrease in fasting and postprandial blood glucose levels in non-insulin-dependent diabetic patients after 40 days of practicing yoga. Noteworthy was the observation that within a mere 10 days, participants experienced recovery, accompanied by a reduction in the use of antidiabetic drugs.<sup>[9,10]</sup>

Moreover, beyond glycemic control, yoga has exhibited positive effects on cognitive brain function, presenting a potential avenue for enhancing cognitive health in individuals with type 2 diabetes. Studies suggest that yoga may serve as a simple, cost-effective adjunctive treatment for non-insulin-dependent diabetes mellitus, reducing the frequency of hyperglycemia and the total area under the oral glucose tolerance test curve.<sup>[11]</sup>

In addition to these empirical findings, the yogic perspective on type 2 diabetes as a stress-related psychosomatic disorder provides a holistic framework. According to this view, the disease originates at the mind level (*Manomaya Kosha*) and, if left untreated, progresses to imbalances at the *pranamaya kosha* level, manifesting as physical symptoms. Yoga, through its comprehensive approach, seeks to restore balance to all aspects of being (the *five koshas*) and promote overall health.<sup>[12,13]</sup>

Despite these advancements, the underlying mechanisms of yoga's antiglycemic effects remain to be fully elucidated. Emerging research also highlights the intricate connections between type 2 diabetes, organ metabolism, and immune system dysfunction. Understanding the physiological and immunological mechanisms at play is crucial for developing more effective treatments and vaccination strategies for individuals with type 2 diabetes.<sup>[14-16]</sup>

The exploration of yoga as a therapeutic intervention for modern epidemics, particularly in the context of diabetes, holds immense promise. As scientific research continues to unveil the intricacies of yoga's impact on health, it becomes evident that this ancient practice transcends cultural boundaries, offering a holistic approach to well-being in our contemporary world.

The core practice of traditional hatha yoga, known as pranayama, centers around the technique of *kumbhaka*, which translates to "breath retention" in Sanskrit. The term "*kumbha*" refers to a pot, symbolizing the human torso as a vessel for breath, featuring openings at the throat and the base of the pelvis. In the context of Ashtanga yoga, where pranayama constitutes the fourth limb, ancient texts such as the Bhagavad Gita and the Yoga Sutras of Patanjali define *kumbhaka* as the "complete cessation of breath".<sup>[17]</sup>

Swami Yogananda underscores the true meaning of pranayama, as per Patanjali, as the gradual cessation of breathing, emphasizing the discontinuance of inhalation and exhalation. Historical texts such as the Dattatreya yogasutra and the Hatha Yoga Pradipika elaborate on the transformative potential of *kumbhaka*, with the latter stating that it forces breath into the central sushumna channel, facilitating the rise of kundalini and liberation.<sup>[18-20]</sup>

The practice of pranayama involves three phases: *puraka* (inhalation), *rechaka* (exhalation), and *kumbhaka* (breath retention). *Kumbhaka*, further categorized into *antar kumbhaka* and *bahya kumbhaka*, represents the cessation of breath at different stages of the respiratory cycle. The Hatha Yoga Pradipika details eight practices of breath retention, emphasizing their impact on the body-mind complex. Patanjali describes *kumbhaka* as a means to awaken Kundalini, leading to physical and mental benefits.

Despite the rich descriptions of *kumbhaka's* effects in ancient yogic texts, empirical research on *kumbhaka* therapy remains limited. A review of the literature on pranayama reveals numerous positive effects on neurocognitive abilities, autonomic and pulmonary functions, as well as biochemical and metabolic activities. Clinical studies demonstrate its efficacy in conditions such as hypertension, cardiac arrhythmias, bronchial asthma, pulmonary tuberculosis, mood enhancement, specially-abled children, anxiety and stress management, pain perception, diabetes, and cancer-related symptoms.<sup>[21]</sup>

Specifically, yogic breathing practices show promise in the prevention and management of various non-communicable diseases, offering a cost-effective and safe approach. A study on diabetic patients employing comprehensive yogic breathing indicates improvements in glycemic control and overall quality of life. The ancient understanding of *prana* as the root of biological systems, connecting the mind and body, presents a holistic perspective, yet this vital subject remains largely unexplored in mainstream science.

## 2. METHODOLOGY<sup>[23]</sup>

The experimental study spanned a 60-day tenure and involved three groups, comprising randomly selected males and females:

- Group I (Kumbhaka Group A):  
15 diabetic participants practicing Kumbhaka along with allopathic medicine.
- Group II (Kumbhaka Group B):  
15 diabetic participants practicing Kumbhaka only, without any medicine.
- Group III (Non-Kumbhaka Group):  
15 Diabetic participants were solely dependent on allopathic medicines without practicing Kumbhaka.

### 2.1. Data Collection

Biochemical reports, physical parameters, and anthropometric measures were recorded at the study's commencement (0<sup>th</sup> day) and conclusion (60<sup>th</sup> day). In addition, biochemical reports and physical parameters were assessed every 15 days within the 60-day period.

### 2.2. Measured Variables<sup>[22]</sup>

Variables recorded at the study's onset and conclusion (0<sup>th</sup> and 60<sup>th</sup> day):

1. Fasting plasma glucose (FPG)
2. 2-h postprandial glucose (2-h PG)
3. Hemoglobin A1c (HbA1c)
4. Blood pressure
5. Weight
6. Height

Variables recorded at 15-day intervals starting from day 0:

1. FPG
2. 2-h PG
3. Blood pressure

### 2.3. Practice Guidelines

- Practices are conducted on an empty stomach.
- No food/beverage gap is required after the main morning Kumbhak.
- Practices are done gently and within one session.
- No water consumption during Kumbhak.
- Practices are performed once daily with a focus on comfort.
- Stillness is emphasized during holds.

## 2.4. General Guidelines

- Practices are conducted when relatively free, preferably in the morning.
- Comfort and stillness are encouraged during exercises.
- Practices conducted under empty stomach conditions.

## 2.5. Before Starting Practices

Empty stomach conditions include:

- 4 h after a full meal.
- 1.5 h after a beverage (fruit juice).
- 2.5 h after tea/coffee.
- 2.5 h after a beverage and light snack.
- 30 min gap after consuming a significant amount of water.
- 2.5 h gap after smoking.
- At least 12 h gap after alcohol consumption.

## 2.6. Sequence of Practices

1. *Suruthi Nyasa Kumbhak*: First thing in the morning.
2. Toilet, walk, gym, yoga, etc. (if done).
3. Bath.
4. Cow Ghee.
5. *Morning Kumbhak (Surya Soma, Humkara Bhastrika Kumbhak)*.
6. Medication (to be taken on an empty stomach).
7. Breakfast, etc.

## 2.7. Data Collection and Statistical Analysis

- Data were collected at 15-day intervals using Apollo Blood Glucose Monitor System and Apollo Blood Pressure Monitor.
- HbA1c was measured at the study's onset and conclusion in a NABL-approved laboratory.
- Statistical analysis was done using GraphPad Prism version 9.0.
- One-way ANOVA and student's paired t-test were used for intragroup comparisons.
- Independent t-test utilized for intergroup comparisons.
- Significance level is set at  $P < 0.05$ .

## 3. RESULTS

The study aimed to evaluate the impact of Kumbhaka therapy on type 2 diabetic adults over 60 days, focusing on the potential reversal of diabetes through metabolic strengthening. Both Group I and Group II, who received Kumbhaka therapy, showed statistically significant changes in biochemical parameters (FPG, 2-h PG, and HbA1c). These findings suggest the effectiveness of Kumbhaka therapy in reducing blood glucose levels, with or without concurrent medication use.

The observed outcomes strongly suggest that the Kumbhaka practices have stimulated the organs responsible for regulating insulin functions and production, enhancing their respective capacities. This indicates a notable increase in the subjects' overall metabolism. Considering the positive results, there is a promising likelihood of diabetes reversal if these practices are sustained over an extended period.

The significant changes in biochemical parameters exhibited a consistent decreasing trend in mean values for FPG, 2-h PG, and HbA1c between Day 0 and Day 60 in both Group I and Group II. Interestingly, the efficacy of Kumbhaka therapy appeared slightly higher in the non-medicine group (Group II) compared to the medicine group (Group I), evident in the percentage difference between their mean values on Day 0 versus Day 60. Conversely, the control group (Group III), reliant solely on medication, showed

no significant improvement, maintaining consistent glucose levels throughout the study. The graphical representation of results are shown in Figures 1-3.

Furthermore, subjects from both experimental groups reported a significant increase in energy levels at the intervals of Day 0 versus Day 30, Day 30 versus Day 60, and Day 0 versus Day 60, as outlined in Graph. This positive impact on energy levels underscores the potential holistic benefits of Kumbhaka therapy.

A noteworthy finding was the statistically significant improvement in blood pressure, encompassing both diastolic and systolic readings when comparing mean values on Day 0 and Day 60. This suggests that Kumbhaka therapy may extend its benefits to effectively manage other metabolic disorders beyond glucose regulation.

While this study did not closely monitor aspects such as diet and lifestyle, despite advising subjects to maintain a balanced diet and a healthy lifestyle, the positive results highlight Kumbhaka therapy as a promising alternative for managing and preventing Type 2 diabetes.

## 4. DISCUSSION

The results of this study provide compelling evidence regarding the potential therapeutic benefits of Kumbhaka practices in managing Type 2 diabetes. A central observation was the evident stimulation of organs crucial for insulin regulation and production in subjects undergoing Kumbhaka therapy. This augmentation in insulin-regulating capacities, as suggested by the observed enhanced metabolic rates, offers a promising avenue for exploring Kumbhaka's role in diabetes management.<sup>[24]</sup>

A notable trend in the study was the consistent reduction in key biochemical parameters – FPG, 2-h PG, and HbA1c – over the 60-day period for both experimental groups. These findings align with previous studies indicating the potential of holistic practices such as Kumbhaka in regulating blood glucose levels. Intriguingly, the non-medicine group (Group II) demonstrated marginally superior outcomes compared to the medicine group (Group I). This observation may suggest that Kumbhaka therapy can complement conventional treatments or even offer a standalone approach in certain contexts.<sup>[23]</sup>

The control group's consistent glucose levels, despite medication, emphasize the potential limitations of relying solely on pharmacological interventions. It further accentuates the added value that holistic practices such as Kumbhaka might bring to conventional diabetes management strategies.

Another significant outcome pertained to the reported surge in energy levels among participants in the experimental groups. Such enhancements in vitality could be attributed to the holistic benefits of Kumbhaka therapy, which potentially impacts not only physiological but also psychological well-being. The observed improvements in blood pressure readings further extend the potential benefits of Kumbhaka beyond glucose regulation, hinting at its broader metabolic and cardiovascular advantages.

However, some limitations warrant consideration. The absence of rigorous monitoring of dietary and lifestyle factors, although subjects were advised on healthy practices, introduces potential confounders that might have influenced the results. Future studies could benefit from incorporating comprehensive lifestyle assessments to better elucidate Kumbhaka's isolated effects.

The present study underscores Kumbhaka therapy's potential as a complementary or alternative therapeutic modality for type 2 diabetes

management. The observed improvements in biochemical parameters, energy levels, and blood pressure readings advocate for further exploration and integration of Kumbhaka practices in holistic diabetes care regimens.

## 5. CONCLUSION

The findings of this study underscore the effectiveness of a 60-day Kumbhaka practice in reducing both FPG and 2-h PG levels among individuals with type 2 diabetes. Notably, the comparison between Group I (participants practicing Kumbhaka alongside oral medications) and Group II (those exclusively practicing Kumbhaka therapy) indicates superior outcomes in the latter. Conversely, Group III, reliant solely on medications, exhibited minimal variation throughout the study. While these results strongly support the efficacy of Kumbhaka therapy, a more extensive investigation with an extended duration and a larger sample size is imperative to further substantiate these findings.

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Registration number in case of clinical trial, CTRI registration - NA.

## 7. AUTHORS' CONTRIBUTIONS

All the authors contributed equally in design and execution of the article.

## 8. FUNDING

Nil.

## 9. ETHICAL APPROVALS

This study not required ethical clearance.

## 10. CONFLICTS OF INTEREST

Nil.

## 11. DATA AVAILABILITY

This is an original manuscript, and all data are available for only research purposes from principal investigators.

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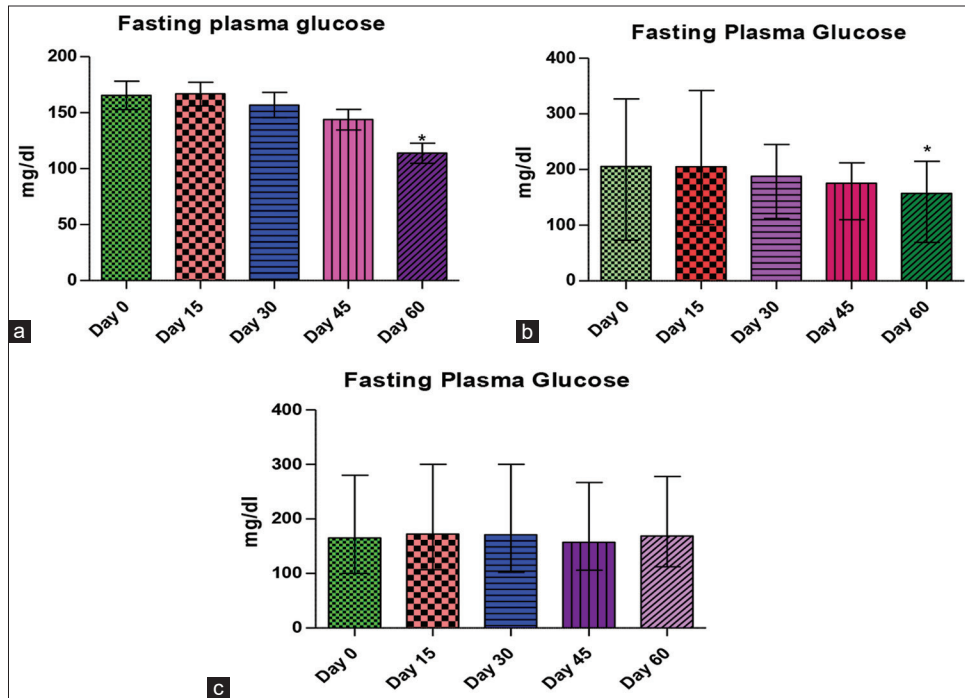
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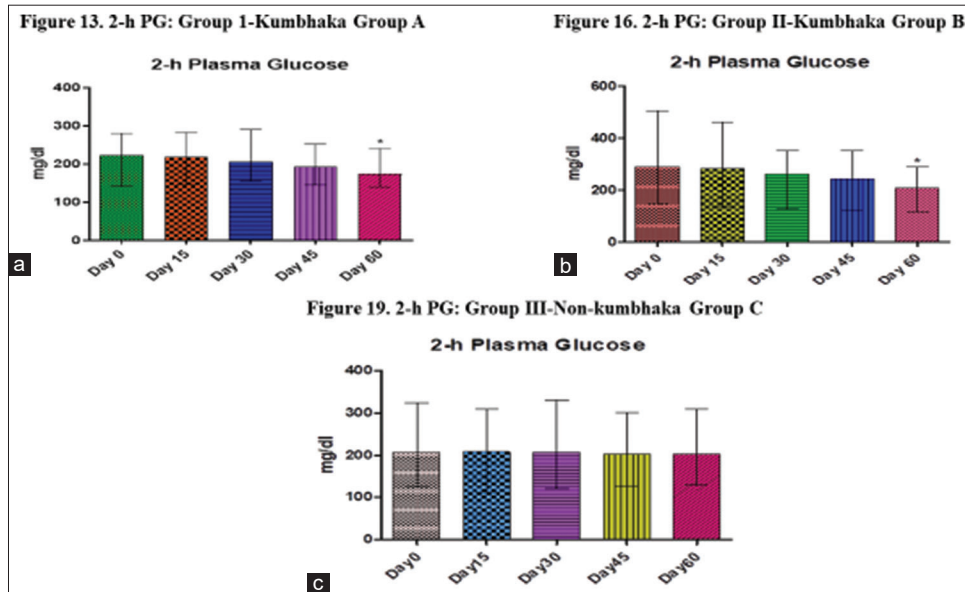
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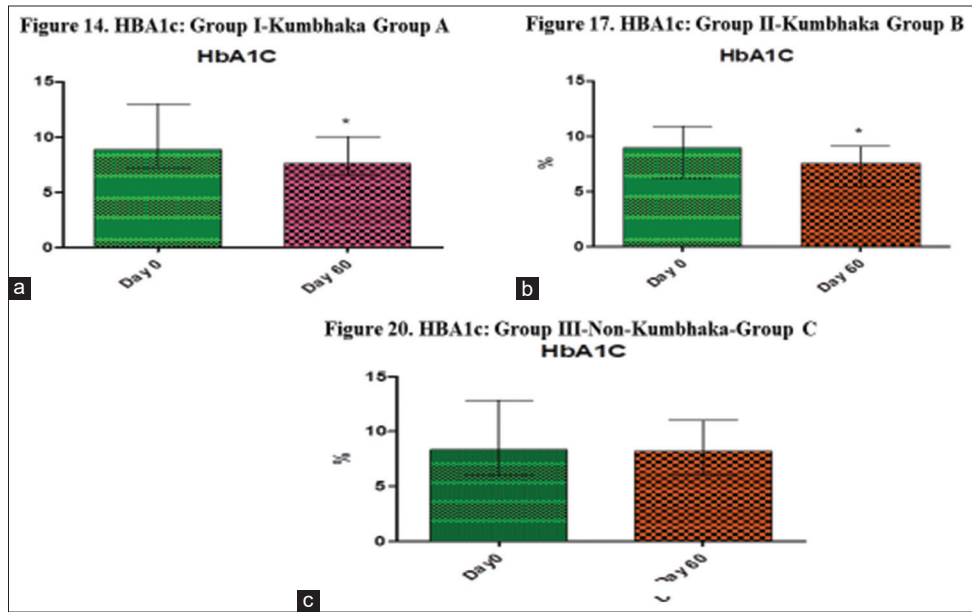
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**Figure 1:** (a-c) Effect of Kumbhaka therapy on fasting blood glucose level of type-2 diabetic patients from Day 0 to Day 60 interval. All data were expressed as mean ± SEM. Where \* $P < 0.05$  (with respect to Day 0) is considered to be significant



**Figure 2:** (a-c) Effect of Kumbhaka therapy on 2-h plasma glucose level of type-2 diabetic patients from Day 0 to Day 60 interval. All data were expressed as mean ± SEM. Where \* $P < 0.05$  (with respect to Day 0) is considered to be significant



**Figure 3:** (a-c) Effect of Kumbhaka therapy on HbA1c level of type 2 diabetic patients from Day 0 to Day 60 interval. All data were expressed as mean  $\pm$  SEM. Where  $*P < 0.05$  (with respect to Day 0) is considered to be significant