

Investigating the mitigating role of mind body intervention on glycemic control in prediabetes: A case report

Navneet Kaur¹, Kalyan Maity², Rakesh Malik³, Shweta Ahuja⁴, Gurmeet Singh⁵, Sarika Dhiman⁶, Kiran Sharma⁷ and Neeru Malik^{2*}

¹Government Model Sanskriti Senior Secondary School Morni Hills, Panchkula, Haryana, India

²Dev Samaj College of Education, Sector 36-B, Chandigarh, India

³Directorate of Sports, Panjab University, Chandigarh, India

⁴MD Pathology, PGIMER, Chandigarh, India

⁵Department of Physical Education, Panjab University, Chandigarh, India

⁶Goswami Ganesh Dutta Sanatan Dharma College, Sector-32, Chandigarh, India

⁷Resident of Dhanas Colony, Chandigarh, India

KEY WORDS

Glycated haemoglobin
Diabetic Yoga Protocol
Indian Diabetes Risk Score
Prediabetes

*Corresponding Author:

Neeru Malik, PhD, Associate Professor

Dev Samaj College of Education,

Sector 36-B, Chandigarh, India

Contact no: +91-9781133666

E-mail: drneerumalikhry@gmail.com

ABSTRACT

In the present case study, the case of a high-risk female participant for diabetes was presented. She is a resident of Dhanas colony, Chandigarh, India. The mapping of risk status for diabetes was done through the Indian Diabetes Risk Score (IDRS) in the participant. She was found to be at high risk for diabetes with a risk score of 60. She joined the Yoga camp organized in the Village Dhanas, Chandigarh. The Diabetic Yoga Protocol (DYP), mainly developed for prediabetics, was given to the participant for 12 weeks. The glycated haemoglobin (HbA1c) was considered the guiding criteria for determining the glycemic threshold for prediabetes. The participant's HbA1c level was 5.8% at baseline, and fasting blood glucose (FBG) was 93 mg/dl. After the 12 weeks of DYP intervention, a significant decline in the HbA1c (5.3%) and FBG (76.9 mg/dl) levels were seen. The present case report supports the efficacy of DYP as an efficient, secure, and cost-effective in reversing prediabetes into normal by ameliorating the glycemic indices.

doi: 10.38205/imcr.030112

Introduction

Type 2 Diabetes Mellitus (T2DM) cases were escalated worldwide, with India having the second-highest number of cases in the world after China (1). T2DM is not only susceptible in the aging populations, though it was also increasing among adults (2). In the condition of diabetes, there is an incongruous rise in the blood glucose levels, which is owed to the inappropriate insulin secretion from the pancreas (3). The various pharmacological treatments existed for glycemic control in T2DM patients, but that also had side effects (4). Generally, people often ignore the initial cautionary symptoms related to diabetes. There are various contributory risk factors like stress, insomnia, lack of physical activity, family history of diseases, and increasing age and weight, which enhanced the risk for accumulation of diabetes (5,6). Therefore, it is imperative to work upon the preventive aspect of T2DM by the timely screening of the high-risk individuals for diabetes at the prediabetic stage (7,8).

Prediabetes is the stage when a person is on the verge of becoming diabetic (9,10). Prediabetes is the middle phase in which the blood glucose levels are lower than the diabetic glycemic threshold but more than the normal glycemic threshold (11). According to American Diabetes Association (ADA), when the person has the HbA1c level between the 5.7–6.4%, FBG- 100–125 mg/dl, that person is

considered prediabetic (12). HbA1c is considered as most reliable method to know the glycemic status of the person (13). In addition, non-invasive methods like the Indian Diabetes Risk Score founded by Mohan et al. (2005) helps to predict the risk status for diabetes based on the two modifiable (age and parental history of diabetes) and two non-modifiable risk factors (waist circumference and level of physical activity) (14).

T2DM is considered a lifestyle-related disorder, and implementing lifestyle changes in the form of diet, exercise, and stress-free life lead to proper prevention and delay in the advancement to diabetes (15,16). Yoga and meditation are well-known integrative practices, which prove to be robust techniques for eradicating elevated glucose levels and other abnormal parameters related to prediabetes (17,18).

Case presentation

The participant is a resident of the Dhanas colony in Chandigarh. She was screened during the house-to-house survey conducted in the community to know the risk status for diabetes based on IDRS. After her screening based on IDRS she was at high risk for diabetes with a risk score of 60, as shown in Table 2. She lived a sedentary lifestyle with a parental diabetes history and had a moderate level of central obesity. All these factors on summation increase her risk

for diabetes. After taking the written informed consent, the measurement for FBG and HbA1c were taken at baseline and after three months. The 10 ml blood was drawn for biochemical assessments.

She joined the three-month Yoga camp held at the Sarpanch house in village Dhanas by a well-trained yoga instructor. The AYUSH-approved diabetic Yoga protocol (DYP), specially designed for prediabetics, was implemented for a one hour duration, six days per week for three months in the training regimen. The previously published research work provided a detailed description of DYP with time and duration (19) and its also shown in Table 4. The result of the hbA1c test at baseline is 5.8%, which falls into the category prediabetes according to ADA guidelines, as shown in Table 3. Moreover, the socio-demographic characteristics of the participant were also given in Table 1. After the three months of DYP intervention, promising glycemic control results were seen. The HbA1c (5.3%) and FBG (76.9 mg/dl) show a significant decline after three months of DYP intervention. According to ADA guidelines, the HbA1c value of 5.3% falls into the category of normal HbA1c.

Table 1: Socio demographic characteristics of the study participant

Socio-demographic characteristics	Values
Age (Years)	32
Previous Yoga Experience	No
Marital Status	Married
Education	Post-Graduate
Occupation	Clerical
Socio-economic status	Middle Class

Table 2: Detailed description of the IDRS Score of the participant

Indian Diabetes Risk Score			
Sr. No.	Variables	Values/Response	Score
1.	Age (years)	32	0
2.	Level of Physical Activity	No	30
3.	Parental History	One Parent Diabetic	10
4.	Waist Circumference (cm)	87	20
Total IDRS Risk Score = 60			
Risk Category = High Risk			

Table 3: Biochemical characteristics of participant at baseline and after three months of DYP intervention

Variable	Baseline	After 3 months of DYP Practice
HbA1c (%)	5.8	5.3
FBG (mg/dl)	93	76.9
ADA Category (HbA1c)	Prediabetic (5.7–6.4)	Normal (<5.7)

HbA1c = Glycated Haemoglobin; FBG = Fasting Blood Glucose; ADA = American Diabetes Association

Table 4: Diabetic yoga protocol

Sr. No.	Name of Practice	Duration (min)
1	Starting Prayer: Asatoma Sat Gamaya	2
2	Preparatory Sukshma Vyayamas and Shithililarna Practices 1. <i>Urdhvahastashvasan (Hand stretching breathing 3 rounds at 90°, 135° and 180° each)</i> 2. <i>Kati-Shakti Vikasaka (3 rounds)</i> <i>a) Forward and Backward Bending b) Twisting</i> 3. <i>Sarvangapushhti (3 rounds clockwise, 3 rounds anticlockwise)</i>	6
3	Surya Namaskara (SN) 10 step fast Surya Namaskara 6 rounds 12 step slow Surya Namaskara 1 round *Modified version Chair SN 7 rounds	9
4	Asanas (1 min per Asana) 1. Standing Position (1 min per Asana) Trikonasana, Parvritta Trikonasana, Prasarita Padhasatana 2. Supine Position Jatara Parivartanasana, Pawanmuktasana, Viparitarakarani 3. Prone Position Bhujangasana, Dharuasana followed by Pawanmuktasana 4. Sitting Position Mandukasana, Vakrasana/ Ardhamatsayendrasana, Paschimatanasana, Ardha Ushtrasana At the end, relaxation with abdominal breathing in supine position (vishranti), 10–15 rounds (2 minutes)	15
5	Kriya a. <i>Agnisara:</i> 1 minute b. <i>Kapalabhati (@60 breaths per minute for 1 minute followed by rest for 1 minute)</i>	3
6	Pranayama <i>Nadishuddhi (for 6 minutes, with antarkumbhak and jalandhar bandh for 2 seconds)</i> <i>Bhamari 3 minutes</i>	9
7	Meditation (for Stress, for deep relaxation and silencing of mind) Cyclic Meditation	15
8	Closing Prayer: Sarvebhavantu Sukhina.....	1
	Total duration	60 min

Discussion

Prediabetes is a stage where through proper lifestyle management through optimum physical activity, healthy diet, time-to-time examining glycemic parameters, weight, and stress management, one can prevent the risk of lifestyle-related disorders, especially diabetes (20). By timely knowing their risk status for diabetes, people with prediabetes can cease and delay the conversion from prediabetes to diabetes. The plethora of literature published in the past advocated the beneficial role of Yoga and meditation as a

cost-effective and non-pharmacological way of glycemic control (18,21–23).

In the present case study, the participant religiously and enthusiastically followed the DYP practice. The participant proficiently executed all the practices (e.g., *asana*, *suryanamskar*, *pranayama*, meditation, etc.) included in the training regimen. However, the limitation of the present case study is that no specific dietary changes were suggested to the participant. Although, the participant herself adopts some changes in her dietary pattern, which involves avoiding sweets, rice, fried, packed, and processed foods. A healthy diet pattern can also play a crucial role in managing glucose levels. However, the limitation of the present case study is that no specific dietary changes were suggested to the participant. Although, the participant herself adopts some changes in her dietary pattern, which involves avoiding sweets, rice, fried, packed, and processed foods. A healthy diet pattern can also play a crucial role in managing glucose levels. Additionally, the improvement in general health and reduction in anxiety and stress levels were also observed in the participant (data not shown).

It is pertinent to note that the participant's age is 32 years, and at a young age, she was found to be prediabetic (blood glucose levels higher than normal) due to her sedentary lifestyle. Then she adopts a healthy lifestyle and includes DYP practice in her daily routine, resulting in a significant decline in biochemical parameters, i.e., FBG and HbA1c. The possible reason is that DYP is specifically designed for diabetics and prediabetics, and it works emphatically upon glucose control. The other reason for the amelioration of glycemic indices in the prediabetic participant is that DYP consists of a variety of *asana*, *pranayama*, and *suryanamskara*, which is likely to elevate insulin sensitivity B-cell functionality, improves the glucose secretion in the muscles (16,24,25). Besides, glucose control Yoga practices also works proficiently on managing weight, (26) stress (27), and wholesome well-being of the individual (28).

Conclusion

DYP practices prove to be promising in reversing the prediabetic glucose threshold into normal glucose threshold. The other modifiable risk factors, according to IDRS, also get improved after DYP Practices. Although, the other factors like age, acclimatization, regularity to a training regimen, and well execution of the training program by the participant also play a prominent role in the overall positive impact on the prediabetic condition.

Acknowledgement

The authors acknowledge MHRD/ICSSR to support for the research. The authors would like to thank the study participant for their involvement in the trial.

Author's contribution

NK: writing, analysis of data, data collection

KM: Data Collection

RM: Editing, Writing, Co- Conceptualization

SA: Editing of Manuscript

GS: Editing of manuscript

SD: Data Collection

KS: Participant

NM: Conceptualization, study design, Editing.

Ethical statement

Ethical clearance was taken from Institutional Ethics Committee of Panjab University (PUIEC), Chandigarh, India (Approval no: PUIEC210312-III-012, dated 6th April, 2021).

Informed consent

Yes.

Source of funding

This study has been supported by Indian council of Social Science research (MHRD-ICSSR) via Letter no. F.No. **P3939/710 IMPRESS/P3939/2018-19/ICSSR**.

Conflict of interest

The author declares no conflict of interest.

Received Date: 27-12-21; Revised Date: 03-02-22

Accepted Date: 05-02-22

References

1. Atlas D. International diabetes federation. IDF Diabetes Atlas, 7th edn. Brussels, Belgium: International Diabetes Federation. 2015.
2. Guariguata L, Whiting DR, Hambleton I, Beagley J, Linnenkamp U, Shaw JE. Global estimates of diabetes prevalence for 2013 and projections for 2035. *Diabetes research and clinical practice*. 2014 Feb 1; 103(2):137–49.
3. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes care*. 2014 Jan 1;37(Supplement 1):S81–90.
4. Salim B. Diabetes mellitus and its treatment.
5. Neel JV. Diabetes mellitus: a "thrifty" genotype rendered detrimental by "progress"? *American journal of human genetics*. 1962 Dec;14(4):353.
6. Safford MM, Russell L, Suh DC, Roman S, Pogach L. How much time do patients with diabetes spend on self-care?. *The Journal of the American Board of Family Practice*. 2005 Jul 1;18(4):262–70.
7. Laaksonen DE, Lindström J, Lakka TA, Eriksson JG, Niskanen L, Wikström K, Aunola S, Keinänen-Kiukaanniemi S, Laakso M, Valle TT, Ilanne-Parikka P. Physical activity in the prevention of type 2 diabetes: the Finnish diabetes prevention study. *Diabetes*. 2005 Jan 1;54(1):158–65.
8. Lindström J, Ilanne-Parikka P, Peltonen M, Aunola S, Eriksson JG, Hemiö K, Hämäläinen H, Härkönen P, Keinänen-Kiukaanniemi S, Laakso M, Louheranta A. Sustained reduction in the incidence of type 2 diabetes by lifestyle intervention: follow-up of the Finnish Diabetes Prevention Study. *The Lancet*. 2006 Nov 11;368(9548):1673–9.
9. Anjana RM, Pradeepa R, Deepa M, Datta M, Sudha V, Unnikrishnan R, Bhansali A, Joshi SR, Joshi PP, Yajnik CS, Dhandhanika VK. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: Phase I results of the Indian Council of Medical Research–India.
10. Anjana RM, Rani CS, Deepa M, Pradeepa R, Sudha V, Nair HD, Lakshmi-priya N, Subhashini S, Binu VS, Unnikrishnan R, Mohan V. Incidence of diabetes and prediabetes and predictors of progression among Asian Indians: 10-year follow-up of the Chennai Urban Rural

- Epidemiology Study (CURES). *Diabetes care*. 2015 Aug 1;38(8):1441–8.
11. Ferrannini E, Gastaldelli A, Izzo P. Pathophysiology of prediabetes. *Medical Clinics*. 2011 Mar 1;95(2):327–39.
 12. Care D. Jan: 33 Suppl. 1: S62–S69. "Diagnosis and classification of diabetes mellitus." American Diabetes Association. 2010.
 13. Nagarathna R, Kaur N, Anand A, Sharma K, Dada R, Sridhar P, Sharma P, Singh AK, Patil S, Nagendra HR. Distribution of glycosylated haemoglobin and its determinants in Indian young adults. *diabetes research and clinical practice*. 2020 Jan 1;159:107982.
 14. Mohan V, Deepa R, Deepa M, Somannavar S, Datta M. A simplified Indian Diabetes Risk Score for screening for undiagnosed diabetic subjects. *Journal of the Association of Physicians of India*. 2005;53:759–63.
 15. Riley KE, Park CL. How does yoga reduce stress? A systematic review of mechanisms of change and guide to future inquiry. *Health psychology review*. 2015 Aug 7;9(3):379–96.
 16. Thangasami SR, Chandani AL, Thangasami S. Emphasis of yoga in the management of diabetes. *J Diabetes Metab*. 2015 Oct 1;6(613):2.
 17. Cui J, Yan JH, Yan LM, Pan L, Le JJ, Guo YZ. Effects of yoga in adults with type 2 diabetes mellitus: A meta-analysis. *Journal of diabetes investigation*. 2017 Mar;8(2):201–9.
 18. Ramamoorthi R, Gahreman D, Moss S, Skinner T. The effectiveness of yoga to prevent diabetes mellitus type 2: A protocol for systematic review and meta-analysis. *Medicine*. 2019 Jan;98(3).
 19. Singh AK, Kaur N, Kaushal S, Tyagi R, Mathur D, Sivapuram MS, Metri K, Bammidi S, Podder V, Modgil S, Khosla R. Partitioning of radiological, stress and biochemical changes in pre-diabetic women subjected to Diabetic Yoga Protocol. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 2019 Jul 1;13(4):2705–13.
 20. Centers for Disease Control and Prevention. National diabetes statistics report: estimates of diabetes and its burden in the United States, 2014. Atlanta, GA: US Department of Health and Human Services. 2014 Jul;2014.
 21. Jyotsna VP. Prediabetes and type 2 diabetes mellitus: Evidence for effect of yoga. *Indian journal of endocrinology and metabolism*. 2014 Nov; 18(6):745.
 22. Echouffo-Tcheugui JB, Dagogo-Jack S. Preventing diabetes mellitus in developing countries. *Nature Reviews Endocrinology*. 2012 Sep;8(9):557–62.
 23. Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, Keinänen-Kiukaanniemi S, Laakso M, Louheranta A, Ras-tas M, Salminen V. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *New England Journal of Medicine*. 2001 May 3;344(18):1343–50.
 24. Kumari S, Mishra D, Chauhan KK, Gupta AK, Sharma KK. [22] SHANKHAPRAKSHALANA: A YOGIC KARMA FOR PURIFICATION. *international Journal of Ayurvedic and Herbal Medicine*. 2012 Jun 19; 2(03).
 25. Raveendran AV, Deshpandae A, Joshi SR. Therapeutic role of yoga in type 2 diabetes. *Endocrinology and Metabolism*. 2018 Sep 1;33(3):307–17.
 26. Lauche R, Langhorst J, Lee MS, Dobos G, Cramer H. A systematic review and meta-analysis on the effects of yoga on weight-related outcomes. *Preventive medicine*. 2016 Jun 1;87:213–32.
 27. Arora S, Bhattacharjee J. Modulation of immune responses in stress by Yoga. *International journal of yoga*. 2008 Jul;1(2):45.
 28. Manchanda SC, Madan K. Yoga and meditation in cardiovascular disease. *Clinical Research in Cardiology*. 2014 Sep;103(9):675–80.