

# General health Status and *Tridosha* analysis of urban high-risk Diabetes after 3- month Diabetes Yoga Protocol: a pilot study

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## KEY WORDS

Anxiety  
Quality of Life  
*Tridosha*  
Diabetes Yoga Protocol  
Urban population  
Indian Diabetes Risk Score

## ABSTRACT

**Background and Purpose:** Stress and anxiety have been closely related to insulin resistance, early appearance of diabetes, and enhanced diabetes progression. Stress and anxiety also have a negative effect on patients' general health status and quality of life. In earlier study Yoga has been proven as an effective intervention for prevention, treatment, risk reduction of diabetes, preventing conversion from prediabetes to diabetes, and reducing diabetes complications. The present study was aimed to identify the diabetes high-risk population and to analyze the effect of 3-month DYP on General health, anxiety, quality of life, and *Tridosha* in the urban high risk for diabetes population.

**Method:** A total of 12 participants were selected for the present study based on inclusion and exclusion criteria and screened through the IDRS scale. Five participants were included in the study based on IDRS score ( $\geq 60$ ). General health, quality of life, State and Trait Anxiety, and *Tridosha* were measured at baseline and after 3 months of Diabetes Yoga Protocol by self-administrated questionnaires.

**Result:** Results showed significant reduction in STAI ( $p = 0.001^{***}$ ) and significant improvement in GHQ-12 ( $p = 0.022^*$ ), Physical health ( $p = 0.018^*$ ), Psychological health ( $p = <0.001^{***}$ ), Environment ( $p = <0.001^{***}$ ), Total WHOQOL ( $p = 0.001^{***}$ ), *Vata* ( $p = 0.007^{**}$ ), *Pitta* ( $p = 0.032^*$ ) and total *Tridosha* ( $p = 0.002^{**}$ ) score after 3-month of DYP.

**Conclusion:** DYP helps in improving, not only the general health, quality of life but also reduces the anxiety levels and *Tridosha* scores in the urban high-risk Diabetic population.

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## Introduction

Diabetes is one of the most profusely increasing diseases globally (1). Previous research guesstimate that in 2030, the prevalence of diabetes will be around 366 million (2). Anxiety and stress are closely associated with the prevalence of diabetes. A meta-analysis by Buchberger et al showed depression and anxiety hamper diabetes management in youth (3). A study by Ruissen et al showed increased stress and anxiety were closely associated with increased blood glucose levels compared to the last known blood glucose level which was measured before the exposure of stress and anxiety (4). Another study showed a strong association of stress with insulin resistance (5) and type II diabetes (6). On the other hand, stress is also associated with early-onset of diabetes and enhanced diabetes progression (7). Different mental conditions like anxiety and depression can increase the double risk of conversion rate from pre-diabetes to diabetes (8). Stress and anxiety have a direct effect on the quality of life. The study showed perceived stress is negatively associated with quality of life (9). Deterioration of quality of life is connected with worse glycaemic control and elevated comorbidities associated with diabetes (10). Quality of life depends on several lifestyle habits

which can increase the risk of diabetes. Studies showed that inadequate sleep and worse sleep quality increase the risk of diabetes (11). As diabetes is a metabolic disorder our diet pattern plays an important role in diabetes. The study showed wrong diet pattern like overeating increases the risk of diabetes (12). Certain risk factors such as smoking (13,14) and consumption of alcohol (15,16) can also increase the risk of diabetes. Rampant diabetes can lead to several complications such as diabetic neuropathy, which can lead to decreased sensation, ulcers in the foot, or loss of limbs (17).

Yoga is an ancient science that originated in India and helps in balancing mind, body, and emotions (18). Many studies showed that yoga-based lifestyle modification programs have a positive impact on the prevention of diabetes (19,20,21), reduction of diabetes, and its complications (22). The study also showed that yoga can stabilize the lipid profile of the diabetes population (23). The study showed improvement in mental health and glycaemic control after different yogic practices such as diaphragmatic breathing and systemic relaxation (24). Especially in developing countries treatment cost is also a burden for the patients and their family members. Keeping this in mind many studies showed that yoga is a cost-effective treatment to prevent diabetes (25,26).

Recognizing risk factors for diabetes can be used as a preventive measure so that conversion of prediabetes to diabetes and progression of diabetes can be controlled through different treatment modalities. Numerous studies showed the positive effect of yoga to prevent diabetes (27,28,29) by yoga-based lifestyle modification (30,31). The study showed that 58% of the risk of diabetes can be reduced by lifestyle modification and weight reduction at the prediabetes stage (32). Several highlighted studies showed the efficacy of lifestyle modification to prevent and treat diabetes (33,34). Even though lifestyle modification program has a slower effect and poor compliance compared to drug therapy, lifestyle modification program does not have any side effects. On the other hand, it is cost-effective and less likely to create an economic burden for the patients.

In ancient science, Ayurveda was defined as a strategy for healthy living. “Tri” means three elements such as *Vata*, *Pitta*, and *Kapha*, “*Dosha*” means “that which is capable of vitiation”. Balance of three *doshas* is called health and imbalance is called ill-health (35,36). The study showed that arterial stiffness was found to be significantly high in the *Vata* category of the diabetic group compared to the non-diabetes group, whereas arterial stiffness in *Pitta* and *Kapha* group was significantly lower in the diabetes group in comparison to the non-diabetes group (37). Another study by Sivapuram et al showed higher *Pitta* levels in the diabetes population (38).

Even though there are many studies focused to analyze the role of yoga on general health status and *Tridosha* profile very rare studies that studied the role of yoga on *Tridosha* in the diabetes population after specific yoga practice.

Remembering all factors which influence the risk of diabetes, the current study aimed to identify the population with high risk for diabetes and to analyze the effect of 3-month DYP on General health, anxiety, quality of life, and *Tridosha* in the high-risk diabetes population.

## Methods

### Participants

A door-to-door survey was done in Chandigarh city (Sector 23) to select the subject. Male and female participants with age 20–70 years were recruited based on IDRS score  $\geq 60$ . The willing participants had given a written valid consent form. Participants with previous experience of Yoga were excluded. 12 participants were screened, out of that only 5 participants were selected for the study. The participants have less than 60 IDRS were excluded from the study. We have previously published stress, cognitive and biochemical parameters which have shown improvement in the same participants (39).

### Study Design

A single-arm pretest-posttest design was used for this study.

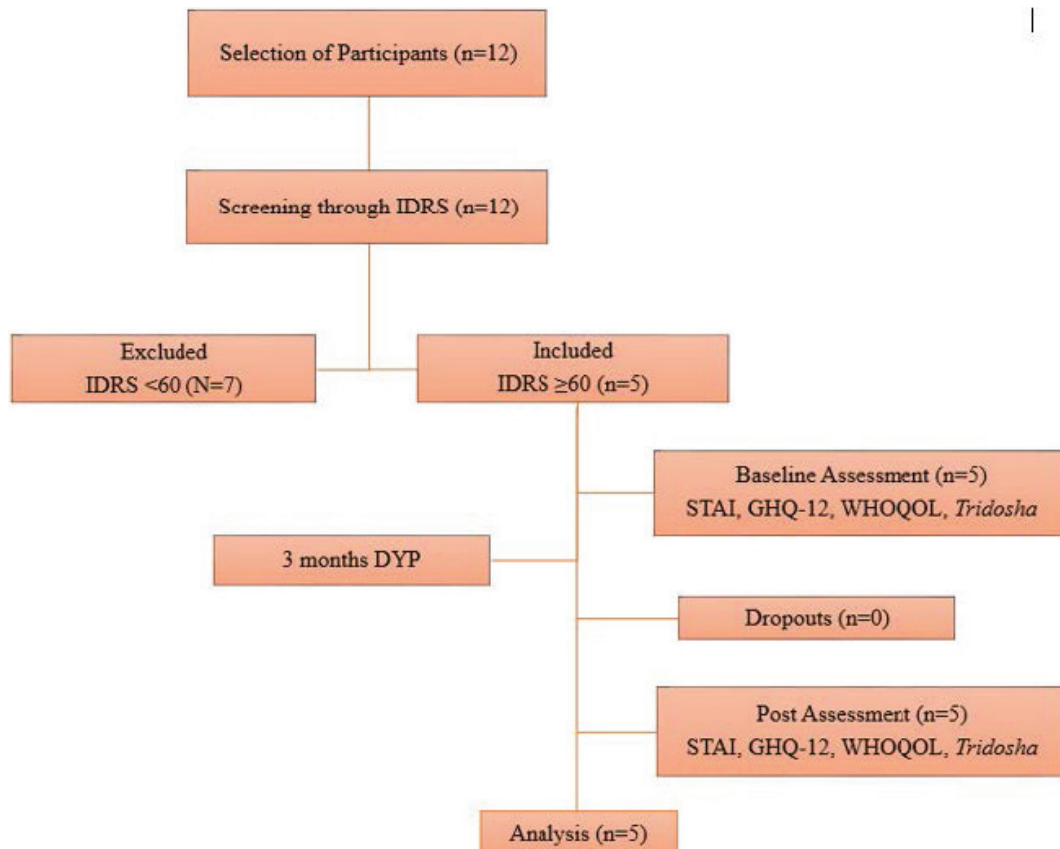


Figure 1: Flow diagram of the study design

### Assessments

The self-administrative questionnaire was provided to participants in a quiet room and asked them to tick appropriate options based on asked questions. All assessments were done in two-time points at baseline and after three months of intervention. The questionnaires which were used for the study are as follows.

**Indian Diabetes Risk Score (IDRS):** High-risk individuals for Diabetes were screened through this questionnaire. IDRS contains four questions. IDRS is a validated scale to measure the Diabetes risk population (40). A score  $\geq 60$  is categorized as high risk (41). Table 1 showed the IDRS questionnaire.

**Table 1:** Indian Diabetes Risk Score

<b>Age</b>	<35 years: 0	35–49 years: 20	$\geq 50$ years: 30		Score:
<b>Parental History of Diabetes</b>	No Family History: 0	Either Parents: 10	Both Parents: 20		Score:
<b>Level of Physical Activity</b>	Vigorous: 0	Moderate: 10	Mild Exercise: 20	No Exercise: 30	Score:
<b>Waist Circumference</b>	<b>For Females</b> <80 cm: 0	<80–89 cm: 20	$\geq 90$ cm: 30		Score:
	<b>For Male</b> <90 cm: 0	90–99 cm: 20	$\geq 100$ cm: 30		Score:
<b>Total Score</b>					

**Total Score:** Low risk: <30, Moderate risk: 30–50, High risk:  $\geq 60$

### General Health Questionnaire-12 (GHQ-12)

This questionnaire contains 12 questions. Scoring ranges from 0 to 3. A higher score represents worse health status (42).

### State and Trait Anxiety Inventory (STAI)

This questionnaire (part 1) is having 20 questions. Scoring ranges from 1 to 4. Questions no 1, 2, 5, 8, 10, 11, 15, 16, 19 and 20 have reverse scoring (1 = 4, 2 = 3, 3 = 2, 4 = 1). A higher score represents higher anxiety levels (43).

### WHOQOL-BREF

The World Health Organization Quality of Life questionnaire comprises 4 domains and 26 questions. The questionnaire included 24 questions that were related to physical health, psychological health, Social Relationships, Environment, and 2 questions estimate the overall quality of life and general health. Scoring was done that ranged from one to five. Greater scores refer to the greater quality of life (44).

### Tridosha Questionnaire

*Tridosha* is a scientifically valid questionnaire (45). It is a shortened version of the *Mysore Tridosha* Questionnaire (46) consisting of a total of 60 questions. Each *dosha* (*Vata*, *Pitta*, and *Kapha*) represent 20 questions that have three promising answers “Does not apply to me = 0”, “Applies to me somewhat = 3”, “Applies to me mostly = 6”.

### Intervention

Diabetes Yoga Protocol (DYP) was used as an intervention for this study. All participants practiced DYP for one hour

daily, six days per week for three months. DYP includes starting prayer, *Sukshma Vyayamas*, *Shithililarna* Practices, *Surya Namaskara*, *Standing asana*, *sitting asana*, *prone*, *supine asana*, *Kriya*, *Pranayama*, Meditation, Resolve, and Closing Prayer. The previous study also used the same protocol in the high-risk women population (47).

### Outcome Measures

Outcomes measures included the parameters such as Anxiety, General health status, quality of life, and *Tridosha*.

### Statistical analysis

Statistical analysis was done by using Microsoft Excel 2016 and SPSS software. For the normality test, the One-Sample Kolmogorov-Smirnov Test was used. The result of the normality test showed p-value was  $>0.05$  in all the variables, hence it was considered that data were normally distributed. Paired samples test was used to compare pre and post-data. The level of significance was  $P < 0.05$ .

### Results

The demographic data shows mean age of male and female participants was 43.4 years. Weight (Mean  $\pm$  SD) 80.4  $\pm$  8.20 Kg, Height (Mean  $\pm$  SD) 167.6  $\pm$  6.42 cm. Significant improvement in STAI ( $p = .001^{***}$ ), GHQ-12 ( $p = 0.022^*$ ), Physical Health ( $p = 0.018^*$ ), Psychological health ( $p < 0.001^{***}$ ), Environment ( $p < 0.001^{***}$ ), Total WHOQOL ( $p = 0.001^{***}$ ) after practice of three months DYP. Also significant reduction was found in *Vata* ( $p = 0.007^{**}$ ), *Pitta* ( $p = 0.032^*$ ) and total *Tridosha* ( $p = 0.002^{**}$ ) score after 3-month DYP.

**Table 2:** Represents Mean, SD, and P-Value of Health Status and *Ayurgenomic* Parameters

Variables	Pre (Mean ± SD)	Post (Mean ± SD)	df	p-value
STAI	54.20 ± 8.64	34.40 ± 4.82	4	<b>0.001***</b>
GHQ-12	20.60 ± 5.22	10.40 ± 7.76	4	<b>0.022*</b>
WHOQOL Physical Health	19.40 ± 3.84	27.60 ± 2.40	4	<b>0.018*</b>
WHOQOL Psychological	17.80 ± 1.30	24.40 ± 1.34	4	<b>&lt;0.001***</b>
WHOQOL Social Relationships	8.80 ± .83	11.80 ± 1.09	4	<b>0.013*</b>
WHOQOL Environment	23.60 ± 3.36	35.80 ± 1.30	4	<b>&lt;0.001***</b>
Overall WHOQOL	69.60 ± 7.70	99.60 ± 3.04	4	<b>0.001***</b>
<i>Vata</i>	70.20 ± 17.31	33.40 ± 12.52	4	<b>0.007**</b>
<i>Pitta</i>	66.60 ± 18.17	46.80 ± 14.78	4	<b>0.032*</b>
<i>Kapha</i>	51.60 ± 10.69	45.40 ± 16.99	4	<b>0.297</b>
<i>Tridosha</i>	188.40 ± 41.10	125.60 ± 40.53	4	<b>0.002**</b>

Data are expressed in Mean, SD, Degrees of freedom, and statistical significance ( $p < 0.05^*$ ,  $p < 0.01^{**}$ ,  $p < 0.001^{***}$ ). STAI = State and Trait Anxiety Inventory, GHQ-12 = General Health Questionnaire-12, WHOQOL = World Health Organization Quality of Life.

## Discussion

The study focuses on the prediction of diabetes based on IDRS score and analyzes the effect of 3-month DYP on General health, anxiety, quality of life, and *Tridosha* of high-risk diabetes. In this study, we have used well-validated questionnaires to measure the above variables.

State and trait anxiety questionnaire is a reliable (reliability between 0.87 and 0.93) tool to measure anxiety (48). Our study demonstrated a significant reduction in state and trait anxiety after 3-month of DYP. The previous study supports our result. The study by Vizcaino showed significant changes in state anxiety after 6-week of Hatha Yoga practice in the diabetes population (49). A study by Singh et al showed a significant reduction in anxiety score in the yoga group in comparison to the exercise group (50).

To measure the general health status of the patient we have used a reliable tool (GHQ-12) with an internal consistency of 0.93 (51). General health was significantly improved after 3-month of Yoga practice. The previous study showed a significant improvement in general health after 12 weeks of yoga practice (52). A study by Rao et al showed significant improvement in general health after one month of mind sound resonance technique (53).

Quality of life was measured by the most validated scale WHOQOL-BREF with good internal consistency (54). The present study showed significant improvement in general health status, physical, mental, and environmental health, and overall quality of life after yoga practice. A study by Kaur et al showed significant improvement in general health, social health, and psychological domain of WHOQOL, overall quality of life in yoga group after 3-month DYP in high-risk for diabetes rural women population (55). In our study, we have been focused on the urban population with both gender, Male and Female. A study by Jyotsna et al showed significant improvement in overall QOL, physical, psychological, and social domain after yogic breathing practice (56).

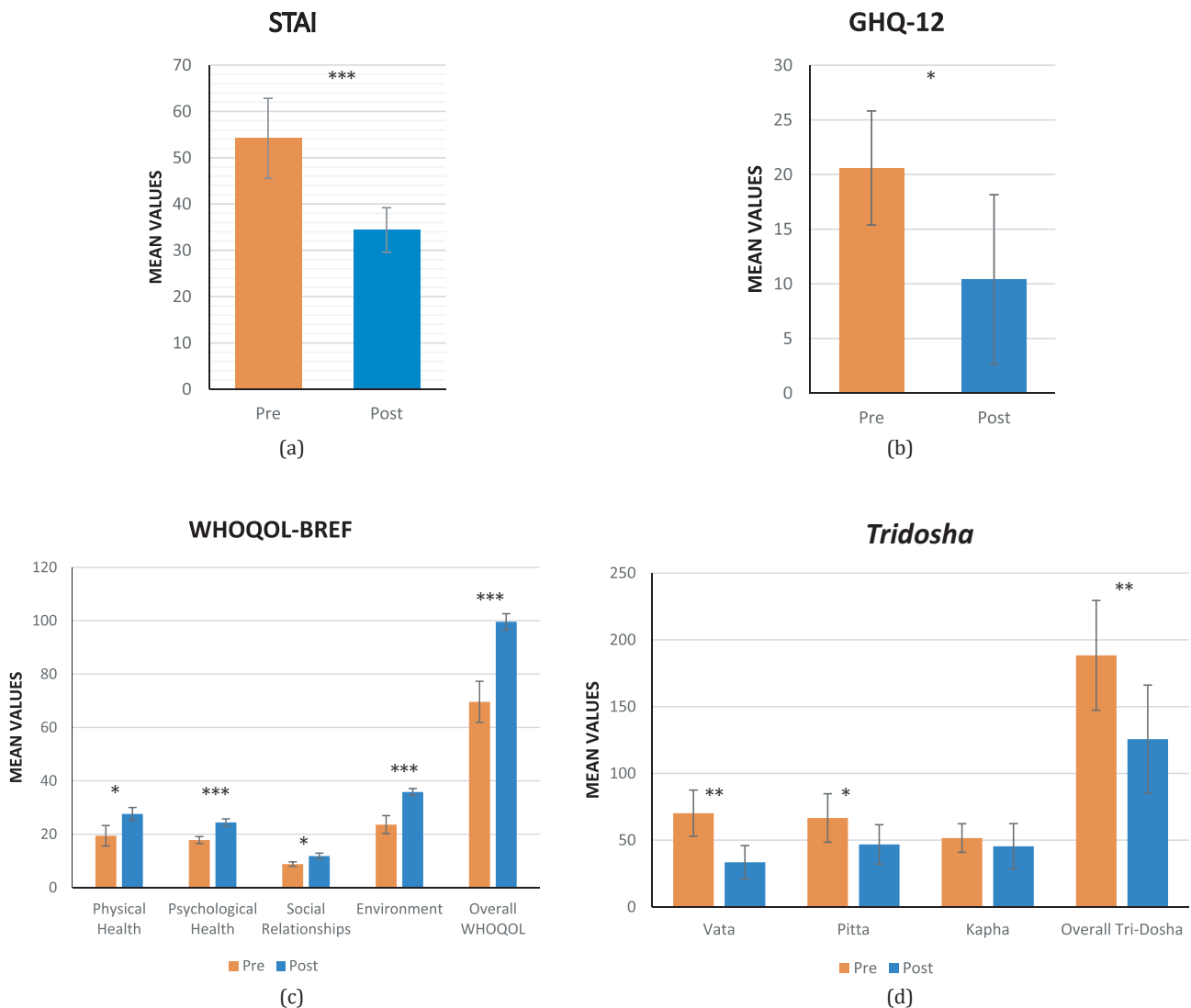
A systematic review of RCT investigates the positive role of yoga on the HPA axis, sympathetic nervous system, cortisol, and anxiety (57). Many studies also demonstrated yogic practices play a potential role in diabetes by reducing different risk factors such as stress, anxiety depression, cortisol secretion, inflammation, cortisol, and blood glucose level (58,59). The yogic practices also activate the parasympathetic nervous system, lower anxiety, stress, and insulin resistance, which may be associated with improvement of general health status and overall QOL (59,60,61,62).

In *Tridosha* analysis, reduction of *Vata*, *Pitta*, and *Tridosha* total scores were observed after 3-month DYP. There were very less studies that have seen the effect of yoga on the *Tridosha* profile. The study showed *Pitta* is responsible for digestion and metabolism (63). A recent past study showed a higher *Pitta* level in the diabetes population (39). In the present study reduction of *Pitta* level after yoga practice is considered as a positive sign even though we did not analyze the balance of *Tridosha* and their correlation with other variables.

We did not include a control group in our study and also not performed gender analysis due to a very little sample size. That can be considered as a limitation of the study. Future RCT is required to identify the effect of yoga on health status and *Tridosha* in larger urban high risk for diabetes population. Several scientific studies showed the molecular changes in different disease models such as ALS (64,65), macular degeneration (66,67,68), cognitive impairment (69,70,71), neurodegenerative disorders (72,73). Further study should be planned to develop an animal model in diabetes to analyze the effect of yoga at the molecular level and its relation with *Tridosha*.

## Conclusion

DYP is helpful for improving general health, QOL, and plays a potential role to decrease anxiety level and *Tridosha* score in urban high-risk Diabetic population.



**Figure 2:** Bar Diagrams showing changes in STAI (a), GHQ-12 (b), WHOQOL-BREF (c), and *Tridosha* (d) at baseline and after 3 months of Yoga practice

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## Authorship Contribution

KM collected data, analyzed the data, and wrote the manuscript; NK, RM, and GS reviewed the manuscript; NM conceptualized the manuscript.

## Ethical Statement

Ethical approval was obtained from the Institutional Ethics Committee of Panjab University, Chandigarh, India (Approval no: PUIEC210312-III-012, dated 6th Apr 2021).

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## Conflict of interest

None.

## Abbreviations

IDRS – Indian Diabetes Risk Score  
DYP – Diabetes Yoga Protocol  
STAI – State-Trait Anxiety Inventory  
GHQ-12 – General Health Questionnaire-12  
WHOQOL – World Health Organization Quality of Life



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## Corrigendum