

Effect of Yoga on Anthropometric, Biochemical and Cognitive parameters in patients with Type 2 Diabetes Mellitus

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Abstract

Introduction: Diabetes Mellitus (DM) is a global epidemic affecting 150 million people worldwide. Therefore, the various conventional and alternative treatment options are being studied in detail. In this regard, the practice of yoga has shown to provide a better glycemic control to the affected individuals and a corrective influence on the several derangements seen in these patients. **Materials & Methods:** This study was conducted in the Department of Physiology of our institute. 30 patients of type2 diabetes mellitus (T2DM) for duration of 1-5 years were enrolled in the study. Their weight, body mass index (BMI), fasting blood glucose (FBG), glycosylated haemoglobin (HbA1c), and cognitive status using the Mini- Mental State Examination (MMSE) was estimated and recorded. These patients were then subjected daily to yoga-asanas for a period of 60 days, following which the above stated parameters were again estimated and recorded. The observations before and after yoga were then compared and statistically analyzed using the paired t test where a p value<0.05 was considered to be statistically significant.

Results: Following the 60 day yoga regimen, the study found a significant reduction in weight ($p < 0.001$) and BMI ($p < 0.001$). Also, the FBG declined from a mean of 134.37mg/dl to 123.43mg/dl which was found to be statistically significant ($p=0.006$). In addition, HbA1c also showed a significant reduction ($p<0.001$), thereby indicating a better glycemic control in the diabetic individuals following yoga. On comparing the cognitive state of these individuals before and after yoga, we observed highly significant improvement ($p<0.001$) in the MMSE scores of these patients. **Conclusion:** There was a reduction in weight, BMI, FBG & HbA1c and a marked improvement in the cognitive state following yoga in patients with T2DM. Thus, yoga can definitely help in glycemic control, decrease the rate of development of complications and thus improve the quality of life of diabetics.

Keywords: type 2 diabetes mellitus, yoga, body mass index, glycemic control and cognitive state.

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1. Introduction

Diabetes Mellitus is a global epidemic and most common non-communicable disease that affects more than 150 million people worldwide.^[1] Therefore, various causal factors leading to diabetes, diagnostic criteria, multiple derangements caused by it and various available and alternative treatment options are to be studied in detail to tame this global epidemic.

Results from metabolic and epidemiologic studies, provide strong evidence that obesity is causally related to type 2 diabetes.^[2,3] Many studies have reported associations between body mass index (BMI; in kg/m²) and type 2 DM so much so that Banerjee et al's study indicates that for every 1kg of weight gained the risk for diabetes increased by 7.3%.^[4]

The diagnosis of diabetes requires fulfillment of the biochemical criteria as laid down by the American Diabetes Association in the year 2010. HbA1c and FBG constitute two important parameters and in this regard the American Diabetes Association states that an HbA1c >6.5% and FBG >126mg/dl points towards diabetes although the diagnosis may require fulfillment of the other criteria as well.^[5]

Also it has been found that patients of all ages with diabetes mellitus having elevated levels of glycosylated haemoglobin are at high risk of developing cognitive deficits and exhibiting considerable atrophy of the hippocampus.^[6,7]

Conventional medicine for individuals with diabetes has been geared towards regulating blood glucose with a combination of dietary modification, insulin and/or oral agents, maintaining ideal body weight, exercising regularly and self-monitoring blood sugar. Yoga is an old, traditional, Indian psychological, physical and spiritual exercise regimen that has been studied for several decades for its role in the management of several chronic diseases including diabetes, hypertension, asthma, obesity, neuromuscular diseases and psychiatric illnesses.^[8] The practice of yoga generally includes meditation, relaxation, breathing exercises, and various physical postures. In diabetics, various yoga-asanas may be directly rejuvenating cells of pancreas as a result of which there may be increase in utilization and metabolism of glucose in the peripheral tissues, liver, and adipose tissues through enzymatic processes.^[9] Thus its effect on various altered parameters of diabetics is to be studied in detail.

2. Aim

This study is to observe the effect of yoga on anthropometric measurements, biochemical and cognitive parameters in uncomplicated type 2 DM patients.

3. Materials & Methods

The study was conducted in the Department of Physiology in collaboration with Department of Medicine of our institute. Thirty type 2 DM patients were randomly chosen from the OPD of the Medicine Department and enrolled into the study. The patients included individuals with uncomplicated type 2 diabetes mellitus, who had been diagnosed for diabetes for a period extending over 1-5 years prior to enrollment into the study. Patients with any known diabetic complication like nephropathy, retinopathy, peripheral neuropathy, coronary artery disease, cerebrovascular accident or other metabolic disease like hypothyroidism were not included in the study. Also patients with history of alcoholism, smoking or neurological disorders including cerebro vascular accidents (CVA), space occupying lesions, epilepsy and developmental anomalies were excluded from the study.

3.1 Anthropometric measurements:

Prior to their induction in the study, formal consent for participation in the study was taken from all the patients. This study was approved by Institutional Ethics Committee. Relevant clinical history, including their past and current medication, lifestyle and dietary habits was recorded and a detailed general and systemic examination was done. Anthropometric measurements comprising of weight and height were also recorded and the body mass index (BMI) was calculated [(weight in kg) / (height in m)²].

3.2 Investigations prior to yoga:

Blood sample of each patient was drawn after an overnight fasting of 8 hrs and Fasting Blood Glucose (FBG) and glycosylated haemoglobin (HbA1c) was estimated. FBG was determined using the glucose oxidase method and HbA1c was estimated by ion exchange chromatography using kits from Fortress diagnostics.

All the patients were then subjected to Mini Mental State Examination (MMSE) which included an objective questionnaire as given below:

Category	Possible points	Description
Orientation to time	5	From broadest to most narrow. Orientation to time has been correlated with future decline.
Orientation to place	5	From broadest to most narrow. This is sometimes narrowed down to streets, and sometimes to floor.
Registration	3	Repeating named prompts.
Attention and calculation	5	Serial sevens or spelling "world" backwards. It has been suggested that serial sevens may be more appropriate in a population where English is not the first language.
Recall	3	Registration recall.
Language	2	Name a pencil and a watch or brand of an object
Repetition	1	Speaking back a phrase.
Complex commands	6	Varies. Can involve drawing figure/s as shown to the subject which are easy to recall and copy e.g. interlocking pentagons

3.3 Interpretation of Mini-Mental State Examination:

Any score greater than or equal to 25 points (out of 30) is effectively normal (intact). Below this, scores can indicate mild (21-24 points), moderate (10-20 points) or severe (≤ 9 points) cognitive decline.

3.4 Yoga regimen:

All the patients enrolled into the study were made to follow the following yoga regimen for sixty days in Yoga Lab run by AAYUSH under guidance of trained Yoga Instructor.

S.No.	Name of the Yoga-asanas	Duration
	Om - Chanting	5 times
	Deep Breathing	5 mins
	Anulom Vilom	10 mins
	Pad Hastasana	2 times a day – hold for ¼-1 min.
	Ardhachakrasana	2 times a day – hold for ¼-1 min.
	Trikonasana	2 times a day – hold for ¼-1 min.
	Dhanurasana	2 times a day.
	Mandukasana	2 times a day.
	Ushtrasana	2 times a day.
	Vakrasana	2 times a day – hold for ¼-1 min.
	Ardha-Matsyendrasana	2 times a day – hold for ¼-1 min.
	Bhujangasana	2 times a day – hold for ¼-1 min.
	Shalabhasana	2 times a day – hold for ¼-1 min.
	Pawanmuktasana	2 times a day – hold for ¼-1 min.
	Naukasana	2 times a day – hold for ¼-1 min.
	Kapalabhati	200 strokes at one time

3.5 Investigations following yoga:

After practicing the above stated asanas of yoga for sixty days, the blood sample of all patients was again drawn after an overnight fasting of 8 hrs and FBG and HbA1c was estimated. The weight of each one of them was recorded and the BMI calculated. All the patients were then subjected to MMSE again and the observations recorded.

All the data thus obtained was then compiled and statistically analyzed using paired t test and various tests of statistical significance with $p < 0.05$ taken to be statistically significant.

Table 1: Comparison of Weight and BMI before and after 60 days of yoga

	Before	After	p value
Weight (in Kg)	72.70	71.00	<0.001
BMI (in Kg/m²)	30.59	29.87	<0.001

Table 2: Comparison of FBS and HbA1c before and after 60 days of yoga

	Before	After	p value
FBS (in mg/dl)	134.37	123.43	0.006
HbA1c (in %)	9.41	7.07	<0.001

Table 3: Comparison of MMSE scores before and after 60 days of yoga

	Before	After	p value
MMSE score	24.27	25.77	<0.001

4. Results

The present study was aimed at determining the effects of yoga on certain anthropometric, biochemical and cognitive parameters in uncomplicated T2DM patients. In this regard, the present study observed that the weight, and hence, the BMI of the diabetic patients subjected to yoga, declined significantly following the yoga regimen strictly for 60 days as guided by trained yoga practitioners. (Table 1) The study also showed a significant reduction in FBS and HbA1c of the participants after they had undergone yoga. (Table 2) Also the MMSE scores of these patients showed a significant improvement following yoga. (Table 3)

5. Discussion

Diabetes especially Type 2 DM is the leading non-communicable disease worldwide. Due to massive advances in Medicine, the communicable diseases have been brought under control, but because the human lifestyle is progressively changing to a more sedentary one, non-communicable disease, diabetes in particular, have become a menace for mankind.

We are well acquainted with the proverb – “Prevention is better than cure”, so it’s time to educate mankind about the need of introducing exercise in daily routine. More precisely, yoga which takes care of all tissues of the body and their functions in a holistic manner and through various mechanisms has shown a better glycemic control in diabetics and has brought improvement in many other derangements associated with diabetes.

In this regard, the present study had randomly chosen 30 Type 2 diabetes mellitus patients who had been diagnosed for diabetes for 1-5 years prior to enrollment into the study and in whom complications had not set in. All these patients were subjected to a well planned yoga regimen under the supervision of trained yoga practitioners for a period of 60 days. Various parameters of these patients were recorded and compared before and after the study.

The study observed a decline in mean weight of the patients from 72.70 kg before yoga to 71.00 kg after it. As a consequence, a significant reduction ($p < 0.001$) in the BMI of these patients was also observed following the 60 day yoga regimen. Likewise, Singh S et al, (2008)^[9] in their study observed a significant reduction in weight and BMI following 45 days of yoga therapy in T2DM patients. Various other studies have also shown the beneficial effect of yoga on weight and BMI, the recent one being that by Shinde et al^[10] (2013). Obesity being the most important risk factor that predisposes an individual to T2DM, if kept under check by yoga it can be used as a tool for reducing the incidence of diabetes worldwide.

Our study also observed a significant reduction in FBG and HbA1c following the 60 day yoga therapy. The work of Singh et al^[9] also showed significant reduction in FBG following yoga therapy for a period of 45 days. Type 2 diabetes and its precursor insulin resistance are tightly linked to adipocyte hypertrophy in the abdominal adipose tissue.^[11,12] Yoga probably through the stretching and weight reduction exercises acts on the abdominal adipose tissue and brings about an improvement in insulin sensitivity, thereby bringing about a reduction in FBG.

Besides, all the beneficial effects of yoga on various derangements seen in type 2 diabetics quoted in literature, our work observed a significant improvement ($p < 0.001$) in the cognitive functions of type 2 diabetes mellitus patients following yoga, as demonstrated by the MMSE scores. We found the mean scores to improve from 24.27 before yoga to 25.77 after it. Similarly, Santhakumari et al,^[13] (2013), in their work also demonstrated an improvement in the cognition of diabetics following yoga therapy using MMSE. Innes et al,^[14] (2011), in their trial observed that an 8-week meditation program may offer an acceptable and effective intervention for cognitive impairment. This improvement in cognition can probably be attributed to the increased cerebral blood flow resulting from yoga.

Thus, we can say, diabetes is like an iceberg, the more we study about it, the newer things we explore. Thus, the findings of the present study are a contribution to the literature on diabetes.

6. Conclusion

The present study brings to the fore front the positive influence of yoga on the weight, glycemic control and cognitive functions of type 2 diabetes mellitus patients, although the mechanism underlying this, remains uncertain. Also, there has been vast evidence in literature suggesting the benefits of incorporating yoga in the treatment regimen of diabetic patients, as is indicated by its corrective influence on various parameters of diabetic patients. Thus, yoga no doubt help in achieving better glycemic control, decrease the rate of development of complications and thus improve the quality of life of diabetics. Yoga can also be offered to the high risk individuals who are more prone to develop diabetes, the obese individuals for instance, in order to reduce the incidence of diabetes and thus tame this global epidemic.

7. References

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