



IMPACT OF YOGA ON DIABETES

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Abstract

Our culture has a long and illustrious history that includes this. There are a number of earlier literature that make reference to the benefits of yoga in the treatment of specific disorders as well as the maintenance of health in those who are otherwise healthy. Insufficient research has been done to determine how yogic practises could affect the treatment of diabetes. In order to determine the effect that yogic practises have on glycemic control, insulin kinetics, body composition, exercise tolerance, and a variety of comorbidities such as hypertension and dyslipidemia, we conducted well-designed research on both normal people and those who had diabetes. Both short and long-term effects were investigated in these investigations. Diabetes mellitus is one of the chronic non-communicable illnesses that affect the most people all over the world. Diabetes mellitus type 2 is a diverse condition that is defined by a hereditary susceptibility as well as interplay between insulin resistance and malfunction in the pancreatic beta cells. Patients with NIDDM not only have an increase in their glucose level, but they also have a metabolic abnormality of their plasma lipids. The Indian practise of yoga dates back thousands of years. In modern times, yoga has been used in the field of therapy to treat a variety of ailments, including hypertension, diabetes, and asthma, among others. For the purpose of this case study, an investigation on the effect of yoga on type 2 diabetics has been carried out. The research is being done on an outpatient basis in the Department of Physiology at V.S.S Medical College Burla, with assistance from the Department of Medicine and the Yoga Center in Sambalpur. There were a total of sixty individuals with Type 2 Diabetes Mellitus (NIDDM), and they were split up into two groups. Patients in Group I ($n_1 = 30$) who belonged to the Yoga group were instructed to perform various yogic asana for a period of forty days, in addition to taking diabetes medications and following a diet. Patients in Group II ($n_2 = 30$), often known as the control group patients, continued to receive standard medical treatment in addition to their diet. It is possible to draw the conclusion that yoga asana and pranayama might be utilised in conjunction with conventional medical treatment in order to achieve optimal biochemical parameters. Yoga therapy is beneficial for diabetics because it lowers the amount of medication they need to take, increases their physical and mental awareness, and reduces the risk of problems.

Keywords: *yoga, Diabetes, NIDDM*

INTRODUCTION

The above said notion is not only helpful in overcoming the stress created by own but also in tackling the internal mind and body conflicts which otherwise might result in development of many diseases. Diabetes, one of the most common diseases recognized since antiquity by the medical historians, is now becoming a ubiquitous non-communicable disease. In the modern world diabetes being a life style ailment affects the people who are stripped of any physical activity and adopt a life which is against the nature. In India, it is estimated

that nearly 79 million people may suffer from diabetes by the year 2030, when compared to the existence of 1 million people in the year 2000 with diabetes. Diabetes, a complex metabolic syndrome is classically due to an absolute or relative deficiency of the hormone insulin and designated as an impaired metabolism of carbohydrates, fats, and proteins. The beta cells of pancreas play a marked role in secretion of hormone insulin, which is necessary to channelize the glucose into the cells via insulin receptors on the cell membrane. When there is an impaired beta cell function by any cause, the blood sugar level rises in the body which exerts a direct cellular toxic effect damaging various body systems. Diabetes is of two types - type 1 and type 2- former attributable to the pancreatic gland aetiology by the auto immune manner which completely fails to secrete the hormone insulin subsequently, type 2 diabetes is due to the complex interaction of genetics, behavioural, and environmental factors which ends in insulin resistance. Nevertheless type 1 diabetes is generally a manageable disorder; the existence of type 2 diabetes is usually a preventable one. In this era, the incidence of diabetes and its complication has been obsoleted from our hands; the resolution of the primordial prevention for diabetes is solicited. Prediabetes, a condition termed as a phenotypic intermediate hyperglycemia has a higher plasma glucose level within the normoglycemic state and for the prevention of diabetes, the control of prediabetes is mandatory. In India, the prevalence of prediabetes is 8.3% in 2017, and over 3.9 million people are existing with prediabetic status in Tamilnadu. The epidemiologic consideration implies that subjects with prediabetes owe a 4 % to 6 % annual risk for succession to type 2 diabetes and conveys that the small sensory fibre neuropathy occurs as a complication with the prediabetic status. The multiple logistic regression study shows that age, family history of diabetes, abdominal obesity can jeopardize the prediabetes with an additional budding risk by change in life style behaviour, sedentary habits, and urbanization. Henceforth prediabetes, is also called as a “Grey area” between the normal and elevated blood sugar level. Obesity occurring due to excess accumulation of body fat has a constitutional effect on insulin resistance which mainly couples with the type 2 diabetes by certain unknown factors. Obesity being a solitary imminence for prediabetes, controlling the obesity by life style changing measures are compelled for the control of prediabetes. The change in sedentary life habits by means of exercise and yoga can reduce the occurrence of prediabetes. [1]

Nevertheless, sympathetic nervous system activation by means of exercise increases the plasma catecholamines, the yoga asana which activates the parasympathetic system can make the body fit, calm the mind and pave way for a stress-free wellbeing. Even though yoga existed in the world from 3000 BC, in recent days only its practice has been increased. The word ‘Yoga’ means ‘yoke’ in Sanskrit which inferred harnessing oneself in a disciplined way. The science of yoga includes various physical postures, breathing control techniques, relaxation and regulation of the mind via meditation. The slow, static, stretch exercise by means of yoga asanas, ensures that, the down regulation of the hypothalamic- pituitary - adrenal axis (HPA) gearshifts the sympathetic nervous system which are extensively triggered by the stressors to the mind and body, towards the parasympathetic nervous system.

The yogic postures can increase the insulin sensitivity by revitalising the pancreatic beta cell activity. Any form of exercise can decrease the centripetal obesity, but the disciplined way of yoga practice causes overall weight loss, lighten the stress and reduction in free fatty acid levels which partakes a beneficial effect on beta cell function by decreasing the lipotoxicity effect. Furthermore, the meditative practices can slow the cellular aging, improve the epigenetic changes, and increase the insulin secretion and mitochondrial function, by the way of rapid gene expression modality. Thus, the short term and long-term yoga practice can yield a check on lean body mass and bring down blood sugar within normal range. Yoga asanas and pranayama can

control the blood sugar in a cost-effective manner, as there is no requirement of any sophisticated equipment with maximum space or fitness classes.

By bringing about the life style changes, yoga practice keeps the diabetic symptoms in check⁵, possesses the mind body well-being and sustains the hormonal homeostasis. Hence forward, the prediabetic patient symbolically stands at the cross road-

The road they choose to stride will shape their quality of life in the future .

OBJECTIVES

1. To assess the beneficial effects of yoga on blood glucose levels in normal and T2DM volunteers.
2. To study the effect of yoga on prediabetic obese adults.

Benefits of yoga

Most, if not all, people who undergo regular yoga training experience improvements in their mental and physical health.

These benefits can include:

- Better sleep
- Reduced anxiety and depression
- Enhanced feelings of well-being
- Relief from chronic illnesses
- Improved digestion, circulation, and immunity
- Improved posture, flexibility and strength
- Enhanced concentration and energy levels
- Enhanced function and efficiency of respiratory, neurological and endocrine organs

Benefits for people with diabetes

Yoga is considered to be a promising, cost-effective option in the treatment and prevention of diabetes, with data from several studies suggesting that yoga and other mind-body therapies can reduce stress-related hyperglycemia and have a positive effect on blood glucose control.

Controlling mental stress (stress management) is one of the keys of diabetes treatment. When we're stressed, our blood sugar levels increase and elevated blood sugar levels increase the chances of serious complications such as heart disease.[2]

Using controlled breathing techniques, meditation and body postures, yoga and other mindfulness-based programmes train participants to invoke a relaxation response.

This response helps regulate cortisol and other stress hormones, which increases blood pressure and blood glucose levels both play a big role in the development of type 2 diabetes and related complications.

Yoga can also treat diabetes, or in the case of type 2 diabetes, prevent the disease from developing by:

- Rejuvenating pancreatic cells – Yoga postures that aid relaxation (asanas) stretch the pancreas, which can stimulate the production of insulin-producing beta cells.
- Exercising the muscles – Like other forms of exercise, yoga increases glucose uptake by muscular cells, which in turn, helps to lower blood sugar levels, improve circulation and reduce the risk of cardiovascular disease.
- Promoting weight loss – Exercising through yoga can reduce weight and improve weight control, both of which are essential for protecting against conditions such as type 2 diabetes, cancer and heart disease, as well as diabetes management.
- Improving your mental attitude – Regular yoga practice can help to focus the mind and create the right mental approach to dealing with diabetes.
- Whilst the benefits of yoga therapy have been demonstrated in several studies, it is not medically approved in the India as a form of diabetes treatment. Before starting any yoga classes, you should consult with your doctor and diabetes healthcare team and continue with your conventional diabetes care plan.

YOGA

ver 3000 BC Patanjali a Sanskrit scholar and Indian physician given a description for physical yogic postures. Term yoga means harnessing oneself to a discipline (or) way of life which is derived from the Sanskrit word. Yoga is said to be a yoga sutra before in poetic form. Meditation, relaxation, control of breathing, various physical postures are the components of yoga. This yoga has now entered the western life style through Swami Vivekananda's work in the late 19th and early 20th centuries 50.

Types of Yoga:

Dhyana, Pranayama and Asana yoga practices are emphasized to improve health by controlled breathing, meditation and physical posture respectively. Asana yoga is mainly for physical strength, flexibility and endurance.

Physiology of yoga:

Yogic exercises are slow, static muscular exercise. This type of exercise involves all types of muscles of body, that is, skeletal, smooth, cardiac muscle with little expenditure of energy. As it deals with stretching exercises, it keeps the muscle tone normal with flexible joints and spine. Deep diaphragmatic breathing increases the blood flow to brain.

Though the pathogenesis of diabetes involves many risk factors, the presence of obesity and stress plays a major culprit for the disease. Hence yoga is a physical element for controlling the above said factor. Yoga regulates the mental health by down regulating the Hypothalamic Pituitary- Adrenal axis (HPA) and has a check on the sympathetic activity which primarily releases cortisol and catecholamine respectively. Mechanism involved as stretching of body is likely to stimulate dermal or sub dermal pressure receptors which are innervated by vagal afferent fibres. This ultimately gives projection to limbic system including structures of cortisol secreting hypothalamic structures, mainly mediated by pacinian corpuscle of dermis mechanoreceptors

(innervated by vagal afferents). Thus, by increasing vagal activity and decreased sympatho adrenal system activity, improvement in sleep and mood with decreased stress, levels are noted

Thus yoga improves the metabolic profile as follows:

- Decreases the insulin resistance
- Increases the glucose tolerance
- Decreases the oxidative stress
- Decreases the obesity
- Improves the physical function

Additionally, it keeps control of pro inflammatory cytokines (IL1, IL-6, and IL-10) by establishing innate immunity. Increased muscular activity, strength and endurance of muscles with flexibility of joints by various asana reduces the body weight, body adiposity and dyslipidemia by increasing the insulin receptors ⁶⁹ on muscle and keeps the blood sugar level within normal limits. Additionally, practicing of alternate abdominal contraction and relaxation may lead on to renewal of pancreatic islet cell and increase in the sensitivity of beta cells. Thus, yoga does not cure the diabetes but keeps in check of diabetic symptoms and in turn reduces various chronic complications of diabetes and obesity. Yoga acts as adjuvant for diabetes as well as shapes the body and maintains the well-being of the mind.[3]

DIABETES

According to a study conducted by Seema Abhijeet et al, ⁷⁰ in India , diabetes has attained an impending epidemic with more than 62 million individuals with diabetes and the prevalence of diabetes is predicted to double globally from 171 million in 2006 to 366 million in 2030 with a highest increase in India followed by China (20.8 million) and United States (17.7 million) .Thus, India presently faces an ambiguous prospect in relation to the potential problem occurring due to diabetes which is imposed upon the country. However, the incidence of diabetes and its distribution is geographically varied. In India, it is approximately estimated that in rural population around one-quarter of the people are with diabetes when compared to the diabetes in more than half of the urban population. Although the Indian urban population receives good health benefits when compared to rural people, the revolutionized life style in urbanization leads on to the incidence of increased diabetes in urban population. Studies conducted by Indian Council of Medical Research (ICMR) and also by the National urban survey revealed that in the South Indian population the incidence of diabetes is more than North Indian population (11.6%). In south India, distribution of diabetes was more in Hyderabad with 16.6 % followed by 13.5% in Chennai. This contrary between the South India and North India population distribution of diabetes was due to that North Indians are migrant Asian population, whereas South Indians are the host population. Obesity is one of the risk dynamic for diabetes. In India, the prevalence of diabetes is higher when compared to western countries. This paradox has led to the concept of ‘Asian Indian Phenotype’. Briefly, it has been described that, for any given body weight, Asian Indians are having higher waist circumference, higher visceral obesity, greater insulin resistance and more diabetes when compared to western population.

Thus Asian Indians are said to be “Thin Fat Indians”, who are all physically lean but metabolically obese. An epidemiological study was conducted by Mohan et al in the Chennai urban population paying attention to opportunistic screening criteria called Indian Diabetes Risk Score (IDRS) considering India as the epicentre of

worlds diabetic epidemic. In that screening method, they used simple parameters like age, family history of diabetes, physical activity and waist circumference. The IDRS 60 at baseline contributed to 3 times elevated risk for getting diabetes than that from low risk subjects (IDRS). This indicates that IDRS which gives a strong predictive value can be used as a screening tool for diabetes than examining or analysing the subjective symptoms or blood sugar values. Additionally it provides information to identify metabolic syndrome and risk for coronary artery disease (CAD) . In another study, conducted by Anjana R.M et al 12 from Indian Council of Medical Research across 3 states, revealed the risk factors causing diabetes mellitus and prediabetes. They are age, family history, abdominal obesity, hypertension and income status which concluded that the prevalence of diabetes and prediabetes are higher in both urban and rural areas of India compared with earlier studies which showed a potential occurrence of diabetes over urban population.[4]

Yoga for diabetes?

A recent presentation at the 81st Scientific Session of the American Diabetes Association (ADA2021) explored how yoga might be working to reduce the risk of diabetes (6). The trial included participants randomly assigned to doing yoga or walking five times a week for 45 minutes for 3 months. All of the participants were diagnosed with prediabetes, with fasting glucose of 100-125 mg/dL.

Study outcomes measured changes in insulin and c-peptide release after oral glucose dosing at baseline and after 3 months of intervention. Investigators also measured fasting glucose, beta-cell activity (HOMA%), GLP-1, free triiodothyronine, perceived stress and heart rate variability.

How yoga helps in diabetes

The authors found a significant increase in the acute phase of insulin release which was paralleled by increases in c-peptide levels in the yoga group as compared to the control group after 3 months of intervention. Increases in GLP-1 and beta-cell function were also recorded, as were improvements in insulin resistance and measures of heart rate variation in those in the yoga protocol group. Perceived stress levels in the yoga group shifted from severe at the start of the study to moderate at the end, whereas the walking controls had no change. Lastly, the authors found that stress levels were positively correlated to beta-cell function.

Presenting author Raghuram Nagarathna MD (Division of Yoga and Life Sciences, Swami Vivekananda Yoga Research Foundation, Bangalore, India) concluded that “the shift to normoglycemia, due to an increase in acute phase insulin release, was associated with improved autonomic balance and reduced stress after yoga.”

Is it yoga or a lifestyle that improves diabetic health?

“Yoga has multiple components – including a healthy lifestyle. Yoga tells us what to do and what not to do. In the West, and more generally, people think that yoga means postures, breathing exercises, and/or meditation and relaxation practices,” explains independent researcher Kaushik Chattopadhyay MD, (Evidence Based Healthcare, University of Nottingham, UK). The studies by Chattopadhyay et al used the following in a yoga-based program: loosening exercises, sun salutation, yogic poses, breathing practices and meditation.

Dr. Chattopadhyay indicated that there is also some evidence that meditation, for example, works to potentially reduce blood sugar levels (7), but it does not contain the multifaceted holistic approach that true yoga does.

There is also some evidence that Tai Chi can impact blood sugar positively (8). What differs is the healthy lifestyle component promoted in these yoga programs – healthy diet, smoking cessation, no alcohol consumption.

A “relevant package” of diabetic interventions is required to be effective, says Dr. Chattopadhyay. He also notes that those practices need to be developed, implemented widely, and most importantly, evaluated with a randomized controlled trial.

For now, Dr. Chattopadhyay thinks it is too early to draw hard conclusions about preventing diabetes with yoga practice. However, if a number of high-quality studies find it to be beneficial, “yoga will be another evidence-based choice available to people to prevent type 2 diabetes.” It might also be one that many would appreciate as a gentle, holistic method of improving their health.

MATERIAL AND METHOD:

The study of the assessment of biochemical parameters before and after 40 days of Yogic exercises by Type 2 Diabetes Mellitus patients was conducted in the Departments of Physiology Medical College odisha with the help of Department of Medicine. The institutional ethical committee had approved the study protocol and design.

SELECTION OF SUBJECTS: Sixty patients of Type 2 Diabetes Mellitus (NIDDM), with a history of diabetes for 0-10 years, in the age group of 40 – 60 years, were selected. The diagnosis of Type 2 Diabetes Mellitus (NIDDM) patients were done according to the WHO criteria. The scope and objectives of the present study was explained to all the subjects. A written, duly signed consent was taken from the subjects according to the ethical principles of the Indian Council of Medical Research, New Delhi, India.[5]

METHODOLOGY:

The patients were separated into their own groups according to diagnosis. Patients with Type 2 Diabetes Mellitus who belonged to the Yoga group (n1 = 30, males = 20, females = 10) were put through a variety of yogic asanas for a period of forty days in addition to receiving diabetic medications and following a diabetic diet. Approximately half an hour was spent by each of these patients doing yoga postures and breathing techniques known as pranayama. Each day for a period of forty days, the Gangadhar Meher Yogalaya in Sambalpur was the location of the yoga instruction provided by an experienced teacher. Because all of the patients followed the Hindu faith, they do not feel uncomfortable reciting the Om. Patients in Group II (n2=30, Male=18, Female=12) with Type 2 Diabetes Mellitus, also known as the control group patients, continued to receive standard medical treatment in addition to their diet. The control subjects were comparable to one another in terms of age, gender, body mass index (BMI), length of time with diabetes, and glycemic baseline characteristics.

EXCLUSION CRITERIA:

The study exclude the

1. Diabetic patients diagnosed with type 1 Diabetes Mellitus
2. Patients >25 BMI (obese person difficult to do yogic exercise)

3. Alcoholic
4. Patients who are currently participating in some form of yoga exercise
5. individuals suffering from type 2 diabetes mellitus and nephropathy. (An adverse result on a dipstick test for the presence of proteins in the urine ruled out nephropathy.)
6. individuals suffering from type 2 diabetes mellitus who have retinopathy. (In order to rule out the possibility of retinopathy, the participants in the study were given a baseline ophthalmological fundus examination.)
7. Patients suffering from type 2 diabetes mellitus who also have coronary artery disease (In order to rule out the possibility of coronary artery disease, a baseline full ECG was performed on each patient.[6])

YOGA GROUP: Thirty people with type 2 diabetes mellitus were assigned to the Yoga group (n1) and were required to follow a specific diet and take oral anti-diabetic medications as directed by their clinician. In addition, they were required to practise particular yoga postures and pranayama techniques for a period of forty days while being supervised by a yoga specialist. Before starting the yoga exercises (to get baseline values), many critical parameters were recorded, and then those same parameters were measured again after the yoga therapy. The next paragraphs include an enumeration of the observations and the outcomes of the study.

YOGA PROTOCOL: Asana and pranayama were both incorporated into the curriculum for all of the students in the yoga class. Between the hours of 7:00 and 8:00 in the morning, we had practise for a total of thirty to forty minutes. Before beginning yoga practise, it was recommended that the bowels and bladder be completely empty. The duration of each asana was around fifteen minutes, while the duration of each pranayama was approximately fifteen minutes. Shavasana, which helps to regulate breathing, was to be performed in between two different yoga postures by the practitioner. It is essential to focus one's mental awareness on the specific areas of the body that are being worked on when performing an asana. During the course of the yoga practise, this helps to calm the mind. In spite of the fact that careful consideration was given to the unique physical characteristics and constraints of each individual, they were cautioned against exerting an excessive amount of effort in order to achieve the ideal posture. Through consistent effort, the body is honed and refined over time.

S.NO	NAME OF THE ASANAS	TOTAL DURATION
1.	PAWANMUKTASANA (Toe bending & rotation, ankle rotation, Ardha titli & poorna titli asana, wrist bending & rotation, elbow bending, shoulder rotation, head bending & rotation etc.)	2min
2.	SURYANAMASKAR- round 1 (all 24 asanas)	2min
3.	SURYANAMASKAR- round 2(all 24 asanas)	2min
4.	NAUKASANA (5-8 repetitions)	1min
5	VAJRASANA with deep & slow breathing	2 min
6	MANDUKASANA (3-5 repetitions)	2 min
7	ARDHA MATSYENDRASANA (2 times both sides)	1 min
8	SHAVASANA	3 min
9	KAPALABHATI PRANAYAM	5 min
10	BHRAMARI PRANAYAM	3 min
11	ANULOM VILOM PRANAYAM	5 min
12	OM CHANTING	2 min

NAME AND DURATION OF VARIOUS ASANAS INCLUDED IN YOGICEXERCISE

Control Group: In the control group, there were thirty people with type 2 diabetes mellitus who were following the diet and treatment with medication that the doctor had prescribed. To establish a baseline, the biochemical parameters of the control group were measured, and then those same values were measured again after 40 days. The following paragraphs will detail the findings, which are also known as the outcomes of the study.

Biochemical parameters: The Fasting Blood Glucose (FBG), the Post Prandial Blood Glucose (PPBG), the Glycosylated Hemoglobin (HbA1C), and the Lipid Profile are the baseline parameters that are included in the biochemical examinations. Serum cholesterol, serum triglycerides, serum low density lipoprotein (LDL), serum high density lipoprotein (HDL), and serum very low density lipoprotein are all components of the lipid profile (VLDL). The autoanalyser COBAS 400 PLUS was used to perform tests on the patient's fasting blood glucose (FBG), postprandial blood glucose (PPBG), serum cholesterol, serum triglyceride, serum low density lipoprotein (LDL), serum high density lipoprotein (HDL), and serum very low density lipoprotein (VLDL). The indirect ELISA approach was utilised in order to examine glycosylated haemoglobin (HbA1C).[7]

STATISTICAL METHOD: The SPSS programme version 16.0 software resources on the computer were utilised in order to do the analysis on the data pertaining to the biochemical tests. The data were represented using Mean and Standard Deviation. A Student's paired t-test was carried out in order to examine the changes in biochemical parameters that occurred in the case group and the control group at the beginning and conclusion of the research, respectively. The Independent ttest was then used to do a comparison between the changes that occurred in each individual parameter in each of the groups (case and control). P value

OBSERVATION:

Table 1: SEX DISTRIBUTION OF THE SAMPLE

GENDER	YOGA GROUP	CONTROL	PERCENT
MALE	20	18	63.33
FEMALE	10	12	36.67

There were 38 males (representing 63% of the total population) and 22 females in the research (37 percent). There are a total of 30 people in the yoga group, including 20 men and 10 women. In a similar manner, there are 18 males and 12 females in the control group.

Table 2: AGE DISTRIBUTION OF THE SAMPLE

AGE DISTRIBUTION	YOGA GROUP	CONTROL	PERCENT
40-49 YR	18	20	63.33%
50-59 YR	12	10	36.37%

The majority of the diabetes patients who participated in the study were in the age range of 40 to 49 years old (63 percent). There are 18 people in the age range of 40 to 49 years old participating in the yoga group. In a similar manner, there are 20 participants within this age range that make up the control group.

TABLE 3: BMI OF THE STUDY SAMPLE

BMI	18.9-20.9	21-22.9	23-24.9
YOGA GROUP	50%	30.65%	19.35%
CONTROL	48%	25.80%	14.20%

Table- 3 represents the BMI of the sample. BMI was calculated from formula,

$$\text{BMI} = \text{WEIGHT IN Kg} / \text{HEIGHT IN m}^2$$

Persons having BMI < 25 were included in the study sample (YOGA GROUP & CONTROL GROUP) to exclude BMI as confounding factor.

TABLE 4: EFFECT OF YOGA THERAPY ON BLOOD GLUCOSE LEVELS IN TYPE 2 DIABETICS (n1 = 30)

S.NO	Parameters	Before Yoga Mean±S.D.	After Yoga Mean±S.D.	P Value
1	FBG	178.53±64.92	119.20±22.14	<0.05
2	PPBG	260.63±73.62	159.90±52.69	<0.05
FBG		Fasting Blood Glucose In mg/dl		
PPBG		Postprandial Blood Glucose In mg/dl		

There was a substantial drop in the fasting blood glucose (FBG) level, which went from 178.5364.92 mg/dl to 119.273.62 mg/dl. The p value for this change was 0.05, and it was significant. Postprandial Blood Glucose (PPBG) after two hours after meal intake likewise reduced, going from 260.6373.62 mg/dl to 159.952.69 mg/dl, with a p value of 0.05 indicating a significant difference between the two sets of values.

TABLE 5: CHANGES IN BLOOD GLUCOSE BEFORE AND AFTER 40 DAYS IN CONTROL GROUP TYPE 2 DIABETICS. (n2 = 30)

S.NO	Parameters	Initial Mean±S.D.	After 40 Days Mean±S.D.	P Value
1	FBG	200.03±42.67	193.07±43.89	<0.05
2	PPBG	259.5±50.39	251.33±49.02	<0.05
FBG		Fasting Blood Glucose In mg/dl		
PPBG		Postprandial Blood Glucose In mg/dl		

There was a decrease in the fasting blood glucose (FBG) from 200.03±42.67 mg/dl to 193.07±43.89 mg/dl, which was significant at a p value of 0.05. Postprandial Blood Glucose (PPG) after two hour also decreased from 259.5±50.39 mg/dl to 251.33±49.02 mg/dl at a p value of 0.05.

TABLE 6: COMPAIRISION BETWEEN CHANGES OF BLOOD GLUCOSE LEVELS IN YOGA GROUP AND CONTROL GROUP

S. NO	PARAMETRS	YOGA GROUP (n1 = 30)	CONTROL GROUP (n2 = 30)	P VALUE
1	DIFF FBG	59.33±49.89	6.97±13.12	<0.05
2	DIFF PPBG	100.73±41.35	8.17±13.53	<0.05
DIFF FBG	Changes In Mean Fasting Blood Glucose At Beginning Of Study And After 40 Days i.e. End Of The Study in mg/dl			
DIFF PPBG	Changes In Mean Postprandial Blood Glucose At Beginning Of Study And After 40 Days i.e. End Of The Study in mg/dl			

Levene's Test for Equality of Variances was carried out in order to examine the differences and similarities in the shifts in parameters that occurred within the yoga group and the control group. In the case group, there was a significant decrease in both the Mean Fasting Blood Glucose and the Mean Postprandial Blood Glucose as compared to the control group with a p value of less than 0.05.[8]

DISCUSSION

"Effect of yoga on patients with type 2 diabetes mellitus" is the title of the study that is being presented. The research was carried out with the assistance of the Department of Medicine at the V.S.S. Medical College Burla in the Physiology Departments. The Fasting Blood Glucose (FBG), the Post Prandial Blood Glucose (PPBG), the Glycosylated Hemoglobin (HbA1C), and the Lipid Profile are the baseline parameters that are included in the biochemical examinations. It is possible to draw the conclusion that yoga helps in lowering blood sugar levels and keeping diabetes under control based on the statistical analysis of the results obtained in the current study as well as the comparison of those results with those found in other reports that have been published. A research was conducted in 2005 by Manjunatha S, Vempati RP, Ghosh D, and Bijlani RL. 7 to test the theory that yogasanas aid in the treatment of diabetes mellitus by releasing insulin from the pancreas. The findings imply that the practise of asanas led to an increase in the B cells of the pancreas' sensitivity to the glucose signal. [Citation needed] [Citation needed] It appears that the heightened sensitivity will be maintained for a significant amount of time, which will result in a gradual and long-term effect of asanas. The significance of the study lies in the fact that it made a first investigation into the process through which yoga postures have the effect of lowering blood sugar levels. In the current investigation, those participants who practised yoga had significantly lower levels of glucose in their fasting blood. These findings are comparable to those that were published in the papers that may be found in the bibliography that are organised by serial number. 8, 9 The current research found that NIDDM patients who practised yoga had lower levels of glycosylated haemoglobin than those who did not practise yoga. The findings provided in articles 9 and 10 of the bibliography are comparable to the ones presented here. It is not clear what exactly caused the decrease in HbA1c levels. The decrease in glycosylated Hb, on the other hand, protects patients from the early onset of a variety of microvascular and macrovascular problems that are associated with diabetes mellitus. In individuals with type 2 diabetes mellitus, a change in lipid profile status—specifically, an increase in serum HDL and a decrease in serum cholesterol, triglyceride, LDL, and VLDL—prevents the early development of concomitant conditions such as hypertension and coronary artery disease. It is possible that an increase in hepatic lipase and pancreatic lipase at the cellular level is responsible for the improvement in lipid profile that yoga brings about.

This affects the metabolism of lipoprotein and causes an increase in the amount of triglyceride that is taken in by adipose tissue.

CONCLUSION

A person who is obese and practises yoga asanas and pranayama may find that they are more successful at lowering their body weight. As a consequence, some of the potential problems of diabetes mellitus may be avoided. Additional research could be needed to demonstrate that yoga is effective in the management of overweight and obesity. It is possible to draw the conclusion that yoga asanas and pranayama might be utilised in conjunction with conventional medical treatment in order to achieve optimal biochemical parameters. Yoga therapy is beneficial for diabetics because it lowers the amount of medication they need to take, increases their physical and mental awareness, and reduces the risk of problems. Therefore, yogic practises can play a part in the primary prevention as well as the secondary prevention of diabetes. As a result, yoga treatment may be regarded an advantageous adjunct for the management of diabetes mellitus type 2. The most recent findings from scientific research point to the possibility that yoga-based lifestyle changes might have a role in the treatment of type 2 diabetes and the risk factors that are connected with it. It has been hypothesised that immunological and psychoneuroendocrine processes are responsible for the holistic benefits seen in diabetes management. Activation of the parasympathetic nervous system and the anti-stress processes that are linked with it enhance the overall metabolic and psychological profiles of patients, as well as raise insulin sensitivity and improve glucose tolerance and lipid metabolism. Yoga practises such as cleansing processes, asanas, pranayama, mudras, bandha, meditation, mindfulness, and relaxation are known to reduce blood glucose levels and to help in the management of comorbid disease conditions that are associated with type 2 diabetes mellitus. This helps to result in significant positive clinical outcomes.[9]

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