

**YOGA AND ITS EFFECT ON BMI AND GLYCEMIC STATUS IN TYPE 2 DIABETES
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INTRODUCTION

Diabetes Mellitus is a public health problem in developing and developed World and according to World Health Organization (WHO) at least 366 million people worldwide have diabetes in 2011. This figure will rise to 552 million by 2030 and WHO predicts that developing countries will bear the burden of this epidemic in the 21st century and India will be the World Diabetic Capital by 2025.^[1,2]

Yoga, practised in India over thousands of years aims at perfection of body and mind, produces consistent physiological changes and has scientific basis. It is said to help in increasing longevity and to have a therapeutic and rehabilitative effect.^[3]

Yoga is described as physical and mental technique that can be effectively used to create physical and mental well-being. Since its introduction into modern culture, yoga has enjoyed a tremendous growth in popularity as an adjunct to healthy living. The purpose of yoga is to achieve highest level of integration through the control of the modification of mind, experience enduring health and happiness, and improve the quality of life.^[4]

The modern form of yoga is primarily focused on physical exercises (Asanas), breathing exercises (Pranayama), followed by relaxation techniques (Shavasana) or meditation. Yoga has been considered as a potentially economical therapy that may be used alongside medical treatment of diabetes,^[4] especially with the growing evidence that yoga may offer a safe and cost-effective intervention for Type 2 Diabetes mellitus (DM 2).^[5]

Several ancient scriptures make a mention of the usefulness of yoga in the treatment of diabetes mellitus and preservation of health in normal individual.^[6] And based on multiple studies, there is evidence that yoga has not only positive and long term effect on diabetes but it also delays and prevents the complications of the disease.^[7]

By yogic exercises, the muscles absorb the excess glucose in the blood, thereby reducing the blood sugar level. They help the pancreas and liver to function effectively, thereby regulating the blood sugar levels. Asanas help in rejuvenating the pancreatic cells, thereby assisting insulin secretion. The muscular movements also

help in bringing down the blood sugar levels by increasing the glucose utilization. Asanas induce relaxation, which also plays a key role in the healthy functioning of the internal organs of the body.^[8]

AIMS & OBJECTS

To assess the effect of yoga on BMI and glycemic control among type 2 diabetic patients with and without yoga for three (3) months

MATERIAL AND METHODS

Study design: Interventional study.

Study setting: Department of Physiology and Department of Medicine, Regional Institute of Medical Sciences (RIMS) Imphal, in collaboration with Yoga Training And Research Centre (YTRC) bearing registration no. 38 of 1987, Kwakeithel, Imphal.

Study duration: One (1) years: September 2017 to August 2018 Study population: Patients diagnosed with type 2 diabetes mellitus who attended Medicine department, RIMS, Imphal and type 2 diabetic patients who were newly enrolled at YTRC, Kwakeithel.

a) Inclusion criteria

1. Type 2 diabetes mellitus patients newly enrolled at YTRC, between the age group 30 – 75 years, irrespective of sex
2. Type 2 diabetes mellitus patients attending Medicine department, RIMS, Imphal between the age group 30 – 75 years, irrespective of sex.

b) Exclusion criteria

1. Those who did not want to participate
2. Patients who did not come for subsequent visits
3. Patients with past history of yoga training
4. Athletes or patients undergoing any other form of physical exercises

5. Patients with history of chronic illness like uncontrolled hypertension, angina, stroke, renal failure, COPD, tuberculosis, coronary artery disease and musculo- skeletal chest deformity.

Study variables

1. BMI [weight and height]
2. Fasting blood sugar (FBS) in mg/dl
3. Post- prandial blood sugar (PPBS) in mg/dl
4. Glycosylated hemoglobin (HbA1c) in percentage (%)

Recruitment

Patients diagnosed with type 2 diabetes mellitus attending Medicine department, RIMS, Imphal and type 2 diabetes mellitus patients who were newly enrolled at YTRC, Kwakeithel, were screened for eligibility as per the criteria given. (Flowchart 1).

Study tool

1. Digital glucometer: one touch* simple select™ glucometer
2. Diatek kit: diagnostic reagent for quantitative in vitro determination of glycohemoglobin in blood on photometric systems
3. Rossmax weighing scale: calibrated before each reading and recorded to the nearest 0.1 kg
4. Stadiometer: recording made in centimetres (cms).

Procedure & Intervention

For FBS * PPBS: A drop of blood was collected using the automatic plunger and the glucometer strip in the morning after a minimum of eight (8) hours of fasting.

Data handling and analysis

Data were entered and analysed using ibmspss statistics version 21 for windows. data were summarized using descriptive statistics like percentages for categorical data, means (standard deviation) and median for continuous data. student's t- test for data with normal distribution, mannwhitney u- test for data with skewed distribution and paired t- test were used. a p value of < 0.05 was taken as significant.

Ethical issues

The study was carried out after obtaining clearance from the research ethics board (reb), rims, imphal. written informed consent was taken from each participant. privacy and confidentiality were maintained through-out the study by limiting the identifying variables to the

minimum and by using unique identification number. data collected were not linked to identify the individual in any way or data collection process did not harm the participants in any way. access to the data collected was made available only to the investigator and guides. presentation of data was made collectively without identifying the individuals.

RESULTS AND OBSERVATIONS

- The present study was conducted in 180 participants, diagnosed with type 2 diabetes mellitus.
- They were divided by non-randomised trial into two groups:

First group [Intervention group]: T2DM with yoga intervention for 3 months [n=90]

Second group [Comparison group]: T2DM without yoga intervention [n=90]

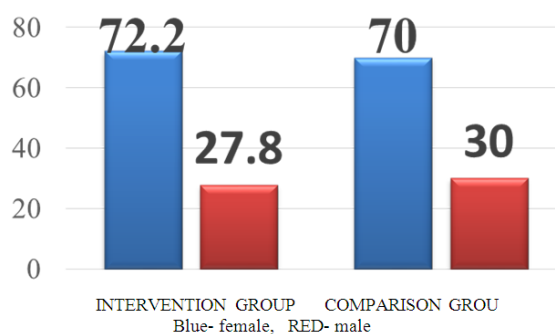


Fig. 1: Gender distribution of the participants (n=180).

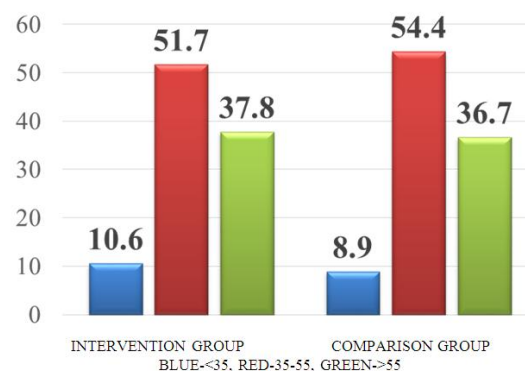


Fig. 2: Age distribution of the participants (n=180).

Table 1: Baseline data of BMI.

BMI	Intervention [n=90]	Comparison[n=90]	p-value
< 23	20.69±1.41	25.47±3.23	0.422
23-25	24.23±0.62	24.58±3.05	
25-30	26.70±1.30	25.87±2.71	
>30	23.69±0.57	23.94±3.42	

Table 2: BMI status after 3 months of Yoga.

BMI	Intervention [n=90]	Comparison [n=90]	p-value
<23	20.24±1.29	25.73±3.21	0.004**
23-25	23.60±0.55	24.84±3.11	
25-30	26.11±1.39	26.06±2.69	
>30	22.64±2.65	24.29±3.65	

Table 3: Glycemic status of Intervention and comparison group.

Characteristics	Intervention group [n=90]			Comparison group [n=90]		
	Before [0 month]	After [3 months]	p-value	Before [0 month]	After [3 months]	p-value
FBS	113.48 ±34.71	112.98 ±33.40	0.101	114.28 ±35.47	114.70 ±34.60	0.098
PPBS	157.12 ±55.58	156.76 ±55.47	0.365	162.40 ±57.19	164.68 ±56.30	0.52
G-Hb	6.18±1.37	5.91±1.34	0.009*	7.12±7.85	6.85±1.35	0.195

DISCUSSION

- In my present study, mean BMI of the two groups, at baseline shows no significant difference [p=0.422]. However, at the end of 3 months, the mean BMI of the Intervention group shows a decrease in all the categories of BMI and increases in the Comparison group [p=0.004]
- This findings are relevant with study done by Parthiban et al
- Similar study of Herur et al reported a significant better response in subjects with BMI of > 25 after 6 months yoga training.
- In our study FBS is reduced but the finding was not significant (p=0.101).
- Chimkode et al reported significant decrease in FBS (p<0.01) after yoga practice for 6 months.
- In our study post-prandial blood glucose is reduced but finding was not significant (p=0.365).
- Singh et al reported a significant reduction in post-prandial blood glucose (p<0.001) when yoga was practiced for 45 days.
- In our study, glycosylated haemoglobin was significantly reduced (p=0.009) in the Intervention group and non-significantly reduced (p=0.195) in the Comparison group which was relevant with study done by Sharma et al.

CONCLUSION

- Based on the findings of the present study, it can be concluded that three (3) months yoga training showed a significant improvement in BMI and glycemic status of type 2 diabetes mellitus patients.
- The glycemic status like FBS and PPBS show a non-significant decrease in the Intervention group and non-significant increase in Comparison groups.
- However, following three (3) months yoga practice, the glycosylated hemoglobin shows a significant

reduction in the Intervention group as compared to Comparison group with no yoga intervention.

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