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## Physiological effects of brisk walking, yoga and non-walking on metabolic parameters and anthropometry among type 2 diabetic patients

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### Abstract

**Background:** The incidence of type 2 diabetes is increasing with the increase in age, physical inactivity and sedentary lifestyle. Main treatment goals of type 2 diabetes are maintenance of good metabolic control, prevention of complications, improvement of psychological health and quality of life.

**Objective:** To compare the Physiological effects of brisk walking, yoga and non-walking among type 2 diabetic patients.

**Material and Methods:** Out of 120 patients 45 agreed for brisk walking, 40 agreed for non-walking and 35 agreed for yoga practice. All the patients were matched for metabolic parameters and anthropometry. Brisk walking protocol for brisk walking group, Yoga protocol for yoga group was followed and Non walking group were asked to do their routine activity. The metabolic parameters like FBS, PPBS, HbA1c, Serum Lipid profile and anthropometric measurements like weight, waist hip ratio, waist circumference, BMI were recorded before & after 3 months. Collected data was analysed using smiths statistical software version 2.8 with t-test & ANOVA,  $p<0.05$  was considered statistically significant.

**Results:** It was found that the brisk walking and yoga exercises had significant beneficial effects in improving the metabolic parameters like FBS, PPBS, HbA1c, TC, Triglycerides, HDL, LDL with  $p<0.05$  and also improving the anthropometric measurements weight, waist hip ratio, waist circumference, BMI with  $p<0.05$ . Non walking group did not have any improvement in either metabolic or anthropometric parameters.

**Conclusion:** Brisk walking and yoga exercises have significant physiological benefits in improving the metabolic parameters and anthropometric measurements among type 2 diabetic patients.

**Keywords:** brisk walking, yoga, type 2 diabetes.

### Introduction

Diabetes is a complex metabolic syndrome with absolute or relative deficiency or inefficiency of insulin [1]. The incidence of type 2 diabetes is also increasing with the increase in age, physical inactivity and sedentary lifestyle. For many physically inactive people who are overweight, any kind of physical activity appears difficult, and this often prevents people who are obese from initiating and adhering to a specific form of physical activity [2, 3, 4]. Main treatment goals of type 2 diabetes are maintenance of good metabolic control, prevention of complications, improvement of psychological health and quality of life [5]. Low levels of physical activity are prominent, independent and modifiable risk factors for the development of type 2 diabetes. A sedentary lifestyle has been associated with increased levels of HbA1c levels [6]. Benefits of exercise in preventing and treating diabetes are widely recognized. It is well established that exercise can improve glycemic control, overall health and quality of life. However patients of diabetes do not necessarily act to create healthier behaviors with regard to nutrition, exercise and weight management [7]. A single bout of physical exercise has insulin like effect, enhancing glucose uptake even in the presence of insulin resistance. Regular exercise training improves insulin sensitivity and blood glucose uptake in subjects with diabetes [8].

Walking is the most common form of activity among adults which is an easily adoptable; convenient relatively safe means among other exercises.

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Also brisk walking is preferred mode of exercise for diabetes and is ideal because it does not require any special equipment, can be done anytime and anywhere [9]. Similarly yoga, which is a way of life includes changes in mental attitude, diet and the practice of specific techniques such as yoga postures (*asanas*), breathing practices (*pranayamas*), and meditation [10] has proven its efficacy in the improvement of oxidative stress as well as in improving the glycemic status of diabetics through neuroendocrinological mechanisms [11]. Data from the national health interview survey demonstrated that among a diverse spectrum of adults with diabetes, walking was associated with 39 % lower all cause mortality and 34 % lower cardiovascular disease mortality. It was further estimated that 1 death per year could be prevented for every 61 people who could walk atleast 2 hours per week [12]. Many studies have been conducted regarding the effect of various types of exercises on glycemic control of diabetic patients but less data is available about the effects of walking in comparison with yoga and non-walking on type 2 diabetes. Hence the present study has been carried out to compare the Physiological effects of brisk walking, yoga and non-walking among type 2 diabetic patients.

## Materials and Methods

The present study was conducted from October 2016 to February 2017 in Department of Physiology, Dr. B R Ambedkar Medical College, Kadugondana Halli, Bangalore and Sakaria hospital and Yoga Centre, Bangalore, India. Ethical clearance was obtained from institutional ethics committee, Dr. B R Ambedkar Medical College, Kadugondana Halli, Bangalore, India and consent was obtained from the participants and were informed of their right to withdraw anytime during the course of the study.

## Study Design

120 male type 2 diabetic patients aged between 40 to 55 years were selected randomly from outpatient departments of medicine & endocrinology. All the patients were counseled about the need of some exercise for good control of blood sugar. Out of 120 patients 45 agreed for brisk walking, 35 agreed for yoga practice and the remaining 40 who didn't agree for any exercises were included as non-walkers. All the patients were matched for metabolic parameters and anthropometry.

## Exclusion Criteria

1. Smokers
2. Alcoholics
3. Suffering from peripheral neuropathy, retinopathy, cardiovascular problems
4. Peripheral vascular disease
5. Thyroid disorders
6. Foot deformity- congenital or acquired

## Brisk walking protocol

Before the starting of brisk walk, the patients were instructed by a qualified physical educator on suitable clothing, shoes, flexing exercises and precautions to be taken when beginning the walking program. After that the patients were asked to perform brisk walking over a rate of 800 meters marked in nearby parks & roads, 5 times a week for 45 minutes with speed of 5-6 km/hour. Speed of walking was calculated by

using formula speed = distance / time. Before the initiation of protocol all the queries regarding maintaining of optimum speed were clarified. Every session started with 5 to 10 minutes of warm up /stretching and ends with cool down period after ending of brisk walking. All patients under brisk walking group were asked to maintain their walking dairy daily. They were instructed to follow brisk walking for 3 months duration. Regular follow up was carried out either telephonically or personally every week about the walking during the course of study period.

## Yoga protocol for yoga group

Patients were taught yoga and pranayama for 3 continuous months, 1 hour every day by yoga expert in the morning between 7.00 am to 8.00 am or 8.00 am to 9.00 am or evening 6.00 pm to 7.00 pm in batches as per the time/batch chosen by the patient.

## Yoga-asanas

1. Surya namaskara, 3-7 turns of each, the pose being maintained for ten seconds adding each turn, every fortnight
2. Tadasana,  $\frac{1}{4}$  minute to one minute for adding  $\frac{1}{4}$  minute per week.
3. Trikona-asana,  $\frac{1}{4}$  minute to one minute for each side, adding  $\frac{1}{4}$  minute per week
4. Pashimottanasana,  $\frac{1}{4}$  minute to one minute adding  $\frac{1}{4}$  minute per week
5. Bhujangasana, 3-7 turns of each, the pose being maintained for ten seconds adding one turn each, every fortnight
6. Vajrasana,  $\frac{1}{4}$  min to 1 min adding  $\frac{1}{4}$  min per week
7. Shalabasana,  $\frac{1}{4}$  min to 1 min adding  $\frac{1}{4}$  min per week
8. Shavasana, 2- 5 minutes, adding 1 minute per week

## Pranayama

1. Bhastrika- pranayama, 3-5 mins per day
2. Kapal- bhati, 5-7mins per day
3. Anulom-viloma, 5-10 mins per day
4. Bhramari, 5 times a day
5. Udgit-Om Uccharan, 5 times a day

## Control group (Non-walking)

Non walking group were asked to do their routine activity. The metabolic parameters like FBS, PPBS, HbA1c, Serum Lipid profile and anthropometric measurements like weight, waist hip ratio, waist circumference, BMI were recorded before & after 3 months. All the patients were advised to continue the prescribed medications at the usual dosage under the supervisions of each patient's usual medical practitioner during the study period. Sample size was determined by considering the results of previously published studies and taking standard normal variate of 0.84 for power of 80% and standard normal variate of 1.96 at 5 % type I error.

Collected data was analyzed using smiths statistical software version 2.8 with t-test & ANOVA  $P<0.05$  was considered statistically significant.

**Drop outs:** 2 patients from yoga group, 2 patients from brisk walking group dropped out of the study due to personal reasons.

## Results

**Table 1:** Baseline anthropometric parameters and after three months among brisk walking, yoga and non-walking groups.

Parameter	Brisk walking (before) n= 43	Brisk walking (after) n= 43	Yoga (before) n = 33	Yoga (after) n = 33	Non walking (before) n= 40	Non walking (after) n= 40
Age(years)	48.45±6.34	-	46.35±7.54	-	47.44±6.89	-
Height(cms)	165 ±3.51	-	166 ±3.88	-	165 ±3.98	-
Duration of diabetes(years)	5.67±2.80	-	5.80 ± 5.2	-	5.90± 4.32	-
Weight(Kg)	76.20±8.45	74.23±6.45	78.34±7.89	73.22 ± 6.89*	77.34±7.70	77.45±7.8
BMI	28.83±1.74	25.6±1.56*	27.86±1.58	25.01±1.46*	27.85±1.44	27.45±1.67
Waist circumference(cms)	100 ±6.96	98±5.78*	101 ±6.34	97.1±6.31*	100 ±5.56	100±5.98
Waist hip ratio	0.93 ± 1.07	0.87±0.91	0.92 ± 1.11	0.83±.80*	0.92± 1.04	0.92±1.05

\* (p<0.05)

**Table 2:** Baseline metabolic parameters and after three months among brisk walking, yoga and non-walking groups.

Parameter	Brisk walking (before) n= 43	Brisk walking (after) n= 43	Yoga (before) n = 33	Yoga (after) n = 33	Non walking (before) n= 40	Non walking (after) n= 40
FBS	154± 35.65	132 ± 23.87*	164 ± 44.22	126±45.36**	160 ± 37.63	158±43.45
PPBS	250.61± 46.16	210 ± 44.43*	265.69 ± 55.6	186±32.67**	261.75 ± 36.6	256±46.37
HbA1c	9.15 ± 0.90	9.04 ± 0.21*	9.33 ± 1.09	9.20±0.90*	9.12 ± 1.02	9.23±1.89
TC	228.92± 32.7	200.34±34.56*	218.10 ± 42.2	192±36.78*	238.92 ± 46.4	241±45.89
Triglycerides	165± 34.65	156±41.22*	172 ± 45.53	146±34.11*	170 ± 47.02	170.67±36.25
LDL	110 ±33.24	102±28.34*	118±36.44	103±27.33*	109±33.56	110±38.34
HDL	35.2 ± 2.51	35.0±3.2*	36.22± 3.36	37.90±2.13*	36.80 ± 3.72	36.80±3.50

\* (p<0.05), \*\* (p<0.01)

## Discussion

In the present study it was found that the brisk walking and yoga exercises was beneficial in improving the metabolic parameters like FBS, PPBS, HbA1c, TC, Triglycerides, HDL, LDL with p< 0.05 and also improving the anthropometric measurements like weight, waist hip ratio, waist circumference, BMI with p<0.05. Non walking group did not have any improvement in either metabolic or anthropometric parameters.

Study conducted on 44 uncomplicated type 2 diabetic patients showed significant benefits of yoga- pranayama practices on metabolic parameters and anthropometric measurements [13] and Similar findings were found by Malhotra, Savita S, Upadhyay VK [14, 15, 16]. Concordantly there was statistically significant decrease in FBS, PPBS, HbA1c, TC, triglycerides, LDL and anthropometric measurements like weight, waist hip ratio, waist circumference, BMI among brisk walking group compared to non-walking group in studies conducted by Chiara Di Loreto [17], Karen Z Walker [18], Lorenzo A Gordon [19], Ekta Arora [20] The most likely mechanism for decrease in blood glucose and HbA1c in diabetic patients would be the stimulation caused by physical activity to increase the number of GLUT-4 and transform it into the cell membrane [21].

The improvement in anthropometric measurements could be that during exercise, the mechanical work associated with muscle contractions requires energy, exercise leads to an increased substrate oxidation by working muscle and the oxidative capacity of muscle increase [22, 23].

Study conducted by Jyotsna Aggarwala among Sedentary men and women suffering from Type II diabetes mellitus (n=20) found that duration of 4 weeks aerobic exercise on Type II diabetic subjects to improve their glycaemic control and lipid profile were not sufficient as it brought significant changes only in the VLDL and triglycerides parameter of lipid profile but not on other parameters and no significant change was found in glycaemic control [24]. Similarly study conducted by Praet S F, while assessing the effects of endurance and resistance types of exercise to improve metabolic control in patients with Type 2 diabetes, found insignificant changes in total cholesterol [25].

## Limitations of present study

1. Diet was not considered and differences in calorie intake could alter the results.
2. Only male patients were selected.
3. Any reduction in the requirement of medications including insulin intake per day was not monitored.
4. Duration of exercise of brisk walking and yoga was only for three months.

## Conclusion

Brisk walking and yoga exercises have significant physiological benefits in improving the metabolic parameters and anthropometric measurements among type 2 diabetic patients.

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## Conflict of Interest: Nil.

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