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Effects of Yoga-Based Program on Glycosylated hemoglobin level and Serum lipid profile in Community Dwelling Elderly Subjects with Chronic Type 2 Diabetes Mellitus -A Randomized Controlled Trial

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ABSTRACT

Background: Yoga practice aids in prevention and management of DM 2, reduce IRS-related risk factors and improve the prognosis. However studies focusing effects of yoga asanas for long duration Type 2 diabetes mellitus in elderly are limited in literature. **Objective:** Effect of yoga asanas on glycosylated hemoglobin level and serum lipid profile in elderly subjects with diagnosis of Type 2 Diabetes Mellitus for more than 15 years. **Methodology**: 60 elderly with Type II diabetes for more than 15 years were recruited from Diabetic Clinic and randomly assigned into Educational group and Yoga group. In Educational group received advice and leaflets on general healthy lifestyle and exercise for every one month. The Yoga group was offered individualized Yoga asanas along with breathing and relaxation which are practiced under supervision for 45-60 minutes daily for 6 days a week over 12 weeks. Outcome measures Glycosylated haemoglobin (HbA_1c) and Serum lipid profile were measured pre and post in both the groups after 12 weeks. **Results:** Mean age of participant's was 65.8±2.6 years with mean duration of diabetes 18.5 ± 2.2 years. Attendance of yoga classes was ranged from 68-90% for the participants. Compared between groups mean difference with 95% CI of outcomes measures in yoga group are glycosylated hemoglobin level .78%, fasting glucose level 28.43mg/dl (18.37-38.94), TC 18.67mg/dl (13.87-23.45), TG 22.05mg/dl (14.35-29.61), HDL 5.2mg/dl (4.54-5.86), LDL 6.81mg/dl (1.21-13.42) with significant difference of $p<0.05$. **Conclusion:** Yoga asanas under supervision have beneficial effects on glycosylated hemoglobin and serum lipid profile in chronic Type II diabetic elderly subjects.

Key words: Diabetes Mellitus, Yoga Asanas.

INTRODUCTION

Diabetes is a chronic illness that requires continuing medical care and ongoing patient self-management education and support to prevent acute complications and to reduce the risk of long-term complications [1]. A distinguishable feature of type 2 diabetes besides hyperglycemia and deranged lipid profile is an impaired insulin secretion, peripheral insulin resistance and obesity which have become a major health concern worldwide.India with estimated 31million diabetics in 2000 and 79mllions by the year 2030 has the highest number of type 2 diabetics in the world [2].

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While diabetes is a glycemic disorder, diagnosed on the basis of elevated blood glucose levels, it is a complex condition characterized by multiple, underlying and interrelated metabolic abnormalities linked to insulin resistance. These alterations, together comprising the insulin resistance or metabolic syndrome, collectively and independently predict the development of DM 2 and related vascular disorders, including atherosclerosis and CVD. Core features of this insulin resistance syndrome (IRS) are glucose intolerance, insulin resistance, atherogenic dyslipidemia, visceral adiposity and high blood pressure. Other abnormalities associated with the IRS and linked to the pathogenesis and progression of DM 2 includes hyper coagulation, chronic inflammation, endothelial dysfunction, oxidative stress and impaired lung function. Increased sympathetic activity, enhanced cardiovascular reactivity and reduced parasympathetic tone have also been implicated in the pathogenesis of IRS and in the development and progression of DM 2 and related cardiovascular complications. In addition, there is mounting evidence that chronic psychological stress and negative mood states are strongly associated, in a bidirectional manner, with insulin resistance, glucose intolerance, central obesity, dyslipidemia, hypertension and other components of the IRS [3].

Conventional medicine for individuals with diabetes has been geared toward 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. Good glucose control can, however, be difficult for many people with diabetes, because these conventional treatment plans require changes to behavior and lifestyle. One important regimen for people with diabetes and for those at risk for developing diabetes is engagement in appropriate physical activity [4]. The beneficial effects of physical activity typically include reductions in glucose level, bodyweight, blood pressure (BP) and cholesterol. However recommended level of physical training 50-70% of maximum aerobic capacity lasting 30 minutes, 3-5 times a week are not feasible in many diabetic patients because of age, obesity, cardiovascular and diabetic related complications. Other barriers for physical activity include time conflicts, poor weather, long-term motivation and compliance [5].

Due to the chronic course of the disease, the debilitation of complications as well as the complexities of treatment plans, people with diabetes often work proactively to manage their condition, optimize their health and alleviate complications through the use of complementary therapies. In light of the strong influence of psychosocial factors on the development of IRS and DM 2, the role of sympathetic activation in the pathogenesis of insulin resistant states, and the bi-directional relationships of these and other IRS-related risk factors, mind–body therapies may hold particular promise for both the prevention and treatment of DM 2 [6-10].

Of particular interest in this regard is Yoga, an ancient mind–body discipline that has been widely used in India for the management of diabetes, hypertension and related chronic insulin resistance conditions. 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 process [11]. The advantages of yoga as option for physical activity in diabetes include (a) the holistic philosophy in which physical exercises are linked to a wider a lifestyle package that also includes diet and relaxation; (b) low cardiovascular demands relative to other forms of exercise; (c) low impact, hence meets a need for people who are obese, have difficulties in mobilization, or contra-indications (e.g. proliferative retinopathy) to strenuous exercise [12].

Recent systematic reviews on yoga based program on management of Type II diabetes mellitus adults has concluded there is growing evidence that yoga practice may aid in the prevention and management of DM 2, reduce

IRS-related risk factors associated with DM 2, and may improve the prognosis and attenuate signs of those with clinical DM 2.however the efficacy of yoga on chronic hyperglycemic diabetes subjects is not retrieved from the literature.[3,4] The purpose of this study were to assess the efficacy of 12-week yoga program among elderly with type 2 diabetes for more than 15 years on Glycosylated hemoglobin,Serum lipid profile and Blood glucose levels.

MATERIALS AND METHODOLOGY

This Study was approved by the Institutional Ethical Committee KMC, Mangalore, Manipal University. Participants were recruited from the Diabetic Clinic which is attached to the hospital. All were middle-class, literate and were on anti-diabetic drugs more than 10 years. The participants was screened for baseline ECG, KFT, LFT, Ophthalmological and Neurological examination to rule out diabetes associated complications After the informed consent the interested participants were screened for eligibility for the study To be eligible, participants had to be more than 60 years of age with DM2 more than 15 years, non-exercisers (no more than 30min twice per week) for the previous 6 months, and at least one of the following cardio-metabolic risk factors: impaired fasting glucose (FPG >110 mg/dl); prehypertension (systolic BP/diastolic BP: 120–139/80–89 mmHg); overweight/ obese [body mass index (BMI) >25 but <45 kg/ m2]; or abnormal level of cholesterol (total cholesterol >200 mg/dl).Subjects were excluded if they were uncontrolled hypertension, severe autonomic or peripheral neuropathy, any history of foot lesions, unstable proliferative retinopathy, albuminuria nephropathy and any musculoskeletal or neurological conditions which limits their performance in physical activity.

Of the 87 interested participants 60 are eligible to recruit for the study. Subjects were then randomly assigned into educational group or yoga group by sealed opaque envelop. Both the groups received advice and leaflets on general healthy lifestyle and exercise. For every one month, the adherence to the lifestyle modification was confirmed through direct interview method. In addition to lifestyle modification Yoga group was offered individualized Yoga asanas along with breathing and relaxation(Table 1) which are practiced under supervision of yoga expert for 45-60 minutes daily for 6 days a week over 12 weeks. All the yoga sessions were conducted at KMC Hospital Attavar. First 4 weeks all yoga asanas (1-11) was started with

Table 1. Name and duration of various pranayamas & yogaasanas included in yoga group

S.No	Name	Duration per Session
1	Vajrasana	30 seceonds
2	Supthavajrasana	30 seconds
3	Tadasana	10 counts for 2 minutes
4	Padahastasana	1 min for each side
5	Trikonasana	1 min for each side
6	paravakonasana	1 min for each side
7	Trikonasana	1 min for each side
8	Vakrasana	1 min for each side
9	Pavanamukthasana	1 min for each side
10	Bujangasana	1 min for each side
11	Shalabasana	1 min for each side
12	Ujjayi Pranayama	4 to 5min
13	Anuloma Viloma Pranayama	4 to 5min
14	Shavasana	10 to 15 min

5 breath holds and later progressed to 8-10 breath holds in the following weeks.

Data Analysis

Data were analyzed using SPSS (version11.5, SPSS, Inc., Chicago, IL, USA), with significance set at 0.05 for two-sided hypothesis testing. Demographic characteristics for each treatment group were described as means and standard deviations for continuous variables, and frequency counts and percentages for categorical variables. To examine the effect of yoga on the major outcome variables compared to the education group, independent sample t test was used to compare their mean differences between baseline and 3 months.

RESULTS

Fifty severn participants finished the program and completed baseline and 3-month visits for the assessments and also the outcome measures.3 drop outs were in yoga group because of comorbid and diabetic complications. Table 2 summarizes baseline demographic characteristics of study participants. In control group mean age of participants in was 66.4 years (SD = 3.8), BMI was 28.14 Kg/m^2(SD 1.38),their mean duration of diabetes 17 years(SD2.8) and 40% of participants had self-reported co-morbidities. In yoga group mean age of participants in was 65.8years (SD = 3.2), BMI was 27.12 kg/m^2 (SD 2.13), their mean duration of diabetes was 19 years (SD 2.13) and 30% of participants had self-reported co-morbidities. The most common co-morbidities reported being hypertension and depression in both the groups.

Table 2. Baseline Demographic information of participants in both the Groups

	Control group n=30 (mean±SD)	Experimental group n=27 (mean±SD)
Age	64.4±3.8 years	65.8±3.2 years
Gender		
Male	22(73%)	14(52%)
Female	8(27%)	13(48%)
Duration of Diabetes	17±2.8 years	19±3.5 years
BMI	28.14±1.38(Kg/m2)	27.12±2.13(Kg/m2)
No of Participants with Co morbid and Diabetic complications	12(40%)	8(30%)

Glycosylated hemoglobin is high in diabetics with chronic hyperglycemia and reflects their metabolic control. Mean change in the primary outcome measure HbA_1c in control group from

Table 3. Post Intervention HbA_1c changes in both the groups

		HbA_1c
Control	before	10.82±.96%
	after	10.44±.36%
Experimental	before	10.28±.86%
	after	9.12±.55%*

*p value <.05

Figure 1. Represents Post Intervention HbA1c % changes in both the groups

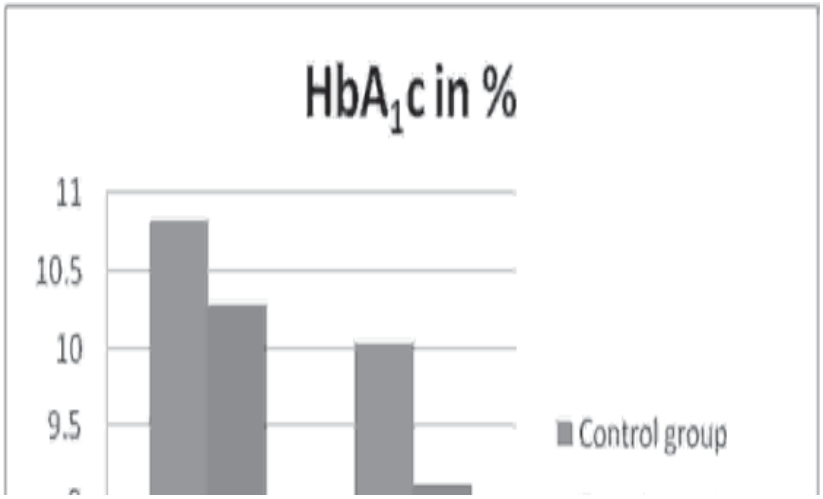

Table 4. Show the Post Intervention glycemic control as well as lipid profile in both the groups

group	Fasting Glucose in mg/dl	Total Cholesterol in mg/dl	Tri Glycerides in mg/dl	HDL in mg/dl	LDL in mg/dl
Control					
before	154.86±16.40	242.63±19	181.23±17.88	35.06±1.50	145.40±17.65
after	144.06±22.58	218.73±9.95	173.16±18.56	36.30±1.40	137.96±15.8
Experimental					
before	163.45±14.8	234.45±25.55	169.74±16.39	35.85±.94	152.18±13.80
after	115.62±13.7*	200.25±8.08*	151.14±7.54*	41.70±1.03*	131.14±6.79*

*p value <.05

Figure 2. Post Intervention glycemic control as well as lipid profile in both the groups

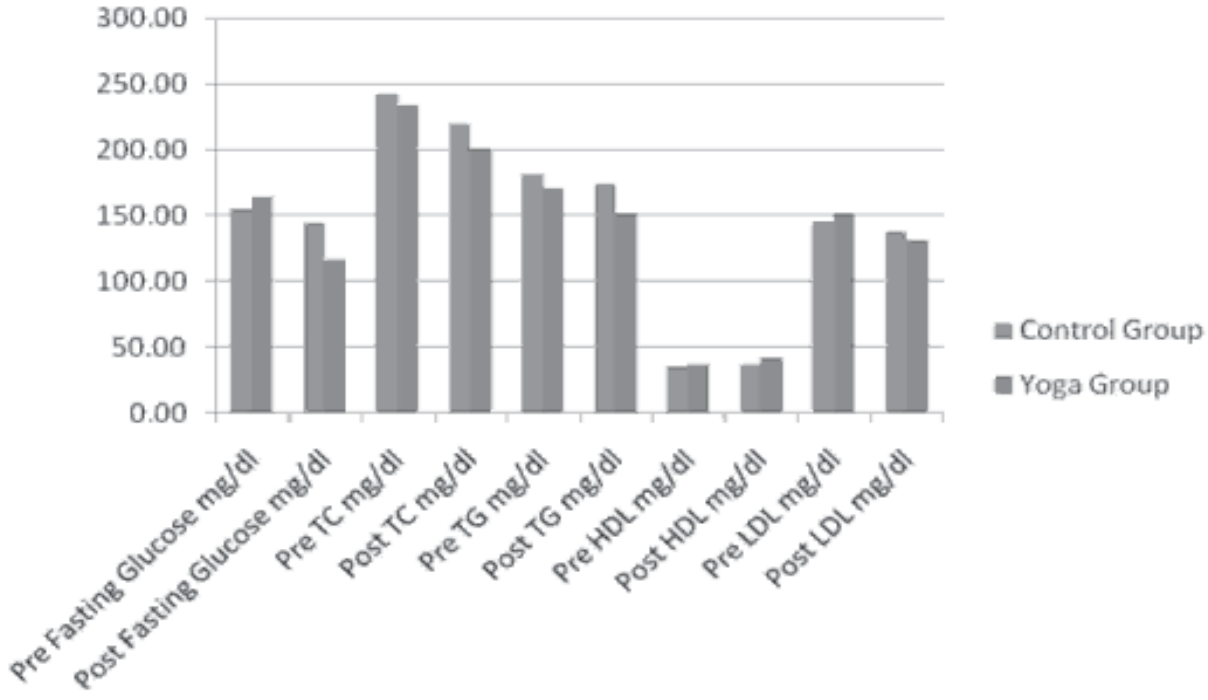

Table 5. Post intervention Mean Differences with 95% CI for outcome measures between Control and Experimental group

Group	HbA_1c in %	FG mg/dl	TC mg/dl	TG mg/dl	HDL mg/dl	LDL mg/dl
Control	.78*	28.43*	18.67*	22.05*	5.2*	6.81**
Experimental	(.64-.92)	(18.37-38.94)	(13.87-23.45)	(14.35-29.61)	(4.54-5.86)	(1.21-13.42)

*p value <.001 and **p value <.05

10.82% to 10.44% and in experimental group the mean change of HbA_1c was from 10.28% to 9.12% which is statistically significant at 95% CI. (Table 3)

DISCUSSION

This present study assessed the feasibility of implementing a yoga program among elderly with chronic hyperglycemia. The preliminary study results indicate that this yoga program is feasible, acceptable and beneficial to this population. Even though we did not use strategies to enhance adherence and retention for this study, all participants completed the yoga program with an average attendance rate of 81.3%.this shows participants are motivated and adherence to the programme. As participants were asked not to change their exercise level by initiating any new form of exercise during this study, we limited our recommendations for physical activity to emphasizing the importance of being active in day-today life for both the groups.

Following 12 weeks of yoga asanas and pranayamam, the yoga group shows significant decrease in Glycosylated Hemoglobin level (HbA_1c), Fasting Glucose level(FG), Total Cholesterol (TC), Triglycerides (TG), Low density lipoprotein(LDL) level and increase in High Density lipoprotein (HDL) from its initial value while control group although showing a reduction didn't show significant change (Table 3). Mechanisms underlying the beneficial effects of yoga practice on diabetes and its related risk profiles are not yet well understood. However, the observed changes may occur via at least two major pathways. First, by reducing the activation and reactivity of the sympathoadrenal system and the hypothalamic pituitary adrenal (HPA) axis and promoting feelings of well-being, yoga may alleviate the effects of stress and foster multiple positive downstream effects on neuroendocrine status, metabolic function and related systemic inflammatory responses. Second, by directly stimulating the vagus nerve, yoga may enhance parasympathetic activity and lead to positive changes in cardiovagal function, in mood and energy state, and in related neuroendocrine, metabolic and inflammatory responses. In addition, yoga may both indirectly (by encouraging healthy lifestyle changes) and directly lead to weight loss and reduced visceral adiposity [13]. The improvement in the lipid profile after yoga could be due to increased hepatic lipase and lipoprotein lipase at cellular level, which affects the metabolism of lipoprotein and thus increase uptake of triglycerides by adipose tissues [14-17].

Decrease in glycosylated hemoglobin in the yoga group is in agreement with the earlier studies Dang and Sahay [5]. Also decrease in lipid profile seen in this study is in agreement with the earlier studies Singh et a[12], Sahay et al[18] Bijlani et[19] and Yang et al[20] reported a significant reduction in free fatty acids, LDL and an increase in HDL. Although improvements were seen in all the parameters in Education group but none were significant. Improvement in control group may be short lifestyle modification and stress management education program leads to favorable metabolic effects as also studied by Bijlani et al [19].

Besides these, following yoga-asanas and pranayamas, many patients reported a feeling of well being, more relaxed and satisfied, and a sense of relief from anxiety. They were more alert and active which could be due to release of opiods and altered adrenocortical activity. Yoga-asanas with its change in posture and

controlled breathing in pranayama influences mental status of an individual allaying apprehension, stress and brings about feelings of well being and hormonal balance [21,22]. The outcome parameters were taken only twice -once at the time of recruitment and other at the end of 3 months, therefore the trend of reduction cannot be commented upon.

CONCLUSION

From the beneficial effects of yoga on diabetes as seen in this study, it may be assumed that adoption of Yoga combined with conventional therapy, on long term basis would bring proper control of glycosylated hemoglobin, blood sugar, lipid profile in elderly subjects with long duration diabetes.

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