Journal of Yoga & Physical Therapy
ISSN: 2157-7595

Mondal et al., J Yoga Phys Ther 2014, 4:4
DOI: 10.4172/2157-7595.1000175

Research Article Open Access

Blood Sugar and Lipid Profile Adaptations to Yoga Therapy

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Abstract

Background: Yoga is generally safe, simple to learn, and can be practiced by even ill, elderly or disabled individuals. Yoga has been shown to have therapeutic benefits for individuals with a wide range of health conditions. The present study was conducted to assess the effect of 12 weeks of yogatherapy on blood sugar and lipid profile in elder women.

Methods: Twenty elderly (age range 50 to 70 years) women were recruited from two old age home and randomly divided into two groups (n=10) of yogic practice group and control group. Yogic practice group were subjected to regular yoga practice (Asanas, Kriyas, Pranayamas) for 12 weeks (3 sessions per week, 45 minutes per session), while the control group did not participated any regular activity. The dependent variables were fasting plasma glucose, post-prandial blood sugar, total cholesterol, triglycerides, low density lipoprotein, very low density lipoprotein and high density lipoprotein and were examined before and after 12 weeks of yogic intervention in both groups.

Results: A significant ($p \leq 0.05$) decrease in fasting plasma glucose, post-prandial blood sugar, total cholesterol, triglycerides, low density lipoprotein and very low density lipoprotein; with a significant ($p \leq 0.05$) increase in high density lipoprotein level from its initial value; while showing insignificant result in control group.

Conclusions: It may be concluded that adoption of yoga on long term basis would bring proper control of blood sugar and lipid profile levels in elderly women.

Keywords: Old age home; Asana; Pranayama; Blood sugar; Lipid profile

Introduction

India has more diabetics than any other country in the world, according to the International Diabetes Foundation. According to recent estimates, approximately 51 million people was diabetes in 2010 and by 2030, 87 million people is expected to have diabetes in India [1]. Keeping in view the alarming increase in the incidence and prevalence of diabetics in India, WHO has declared India as the- Diabetic Capital of the World [2].

Type 2 diabetes mellitus is a global health problem and one of the leading causes of morbidity and mortality for 90-95% of all diabetic cases [3]. The major risk factor for coronary artery disease in diabetes mellitus is dyslipidemia [4]. The characteristic features of diabetic dyslipidemia are a high plasma triglyceride concentration, low high-density lipoprotein (HDL) concentration and increased concentration of small dense low-density lipoprotein (LDL) particles. Insulin resistance leads to increased flux of free fatty acids and hence the lipid changes [5]. Coronary artery disease is the most important cause of death and disability among older women [6]. By the year 2015, cardiovascular mortality is likely to rise to 90% in females in India [7]. High circulating serum cholesterol, low-density lipoprotein-cholesterol (LDL-C) and serum triglycerides are major risk factors of this disease [7,8]. The modification of lipid profile may be important both in the prevention and control of coronary heart disease [8]. Behavioural methods are recommended by the National Cholesterol Education Programme as the first line of prevention and treatment for hypercholesterolemia and other risk factors [9].

Yoga is an ancient traditional Indian [10], psychological, physical and spiritual exercise practice that has been studied for several decades for its role in the management of numerous chronic diseases. It is a form of physical activity consisting of various postures (Asana) and breathing techniques (Pranayama) [11]. Yoga is generally safe, simple to learn, and can be practiced by even ill, elderly or disabled individuals [12]. Yoga has been shown to have therapeutic benefits for individuals with a wide range of health conditions [13,14]. It seems that, yoga improves psychological conditions to manage stress, reduce anxiety and negative emotions, and increase positive emotions and to achieve emotional balance [4,15]. Calderon et al. [9] and Mahajan et al. [8] conducted a study on subjects with mild to moderate hypertension and reported that yoga can play an important role in risk modification for cardiovascular diseases. Another study had reported a better lipid profile in long and medium term mediators when compared to non-meditators [16]. In view of these observations, the present study was undertaken to assess the effect of yoga intervention on blood sugar and the lipid profile in elderly women.

Materials and Methods

This prospective randomized control study was conducted in two old age home, namely Debrup Nibas and Urmila Bridhashram, Kalikapur Colony, Bolpur, Birbhum, West Bengal, India. Twenty elderly women in the age range of 50-70 years were recruited in this study. The subjects were randomly divided into two groups equally; of which first group underwent yogic practice along with the conventional medicines

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Received August 20, 2014; **Accepted** October 10, 2014; **Published** October 16, 2014

Citation: Mondal S, Kundu B, Saha S (2014) Blood Sugar and Lipid Profile Adaptations to Yoga Therapy. J Yoga Phys Ther 4: 175. doi:10.4172/2157-7595.1000175

Yogic Intervention	Position	Name	Time
Asanas	Standing	1. Surya Namaskar	30 minutes
	Sitting	2. Yogamudra 3. Paschimatyasana	
	Kneeling	4. Ardha Matsyendrasans 5. Bhadrasana	
	Prone	6. Bhujangasana 7. Shalabhasana 8. Dhanurasana	
	Supine	9. Nawkasana 10. Sethu Bandhasans 11. Shavasana	
Kriyas	Standing Sitting	12. Kapalabhathi 13. Agnisara	5 minutes
Pranayamas	Sitting	14. Ujjayi 15. Aunloma-Viloma 16. Bhramari	10 minutes

Table 1: Details of yogic intervention.

Blood Sugar	Yogic Practice Group		Control Group		F-value
	Pre Test	Post Test	Pre Test	Post Test	
FPG	168.30 ± 14.86	158.50 ± 11.70	165.30 ± 27.34	165.50 ± 27.03	4.17*
PPBG	236.80 ± 42.60	228.70 ± 42.70	235.60 ± 25.97	236.20 ± 26.67	7.56*
* Significant at the 0.05 level					

Table 2: Descriptive Statistics and Analysis of Covariance for the pre and post test data of blood glucose of yogic practices group and control group.

Blood Sugar	Adjusted Post-test Means		Mean Differences	Standard Error
	YPG	CG		
FPG	156.981	166.662	-9.681*	3.313
PPBG	227.509	236.200	-8.691*	1.605
* Significant at the 0.05 level				

Table 3: LSD test for the differences between the adjusted post tests paired means of blood glucose.

Lipid	Yogic Practice Group		Control Group		F-value
	Pre Test	Post Test	Pre Test	Post Test	
TC	206.90 ± 30.94	201.80 ± 31.70	207.80 ± 36.90	207.90 ± 36.50	21.85*
TG	166.90 ± 28.62	161.90 ± 27.87	159.70 ± 23.64	160.20 ± 23.67	16.17*
LDL	127.50 ± 15.11	123.70 ± 14.89	125.10 ± 17.21	125.00 ± 17.62	18.22*
VLDL	35.00 ± 4.47	32.70 ± 3.74	33.90 ± 3.73	33.90 ± 3.25	8.12*
HDL	47.60 ± 3.66	51.20 ± 3.55	47.40 ± 3.37	47.30 ± 3.33	20.53*
* Significant at the 0.05 level					

Table 4: Descriptive Statistics and Analysis of Covariance for the pre and post test data of lipid profiles of yogic practices group and control group.

and designated as yogic practice group (N=10). The remaining subjects act as control group (N=10). The yogic practice group were treated with their respective training of 45 minutes per day for three days (alternate) a week for a period of twelve weeks. The subjects of the control group were not allowed to participate in any of the training programme and continued with the conventional medicines. The subjects in both the groups as belonged to the old age home (more than 2 years), so it won't be wrong to assume their dietary habits and socio-economic statuses were similar.The clearance from the ethical committee of the Visva Bharati University was obtained and an informed written consent was taken from all the patients after the procedure was explained to them.

The yogic practices training programme was given to yogic practice group for 12 weeks of one session in the morning between 7.00 a.m. to 7.45 a.m. for three days on Monday, Wednesday and Friday. Prior to every training session, subjects underwent 5 to 10 minutes warm-up exercises. Training volume and intensity were increased progressively in 4th and 9th weeks. The details of yogic intervention were presented in the Table 1.

Before the start of experimental treatment, all 20 subjects underwent baseline testing for assessment of their blood sugar (fasting plasma glucose, post-prandial blood sugar) and lipid profile (total cholesterol, triglycerides, low-density lipoprotein, very low-density lipoprotein, high-density lipoprotein). Final testing, which repeat of the baseline tests, was conducted at the end of the 12-week yogic intervention. Blood lipid analyses were performed at the P.M. Hospital Pathological Laboratory of Visva-BharatiUniversity.

Statistical Techniques Used

All the statistical calculations were done with the help of SPSS software Version 17. To find out the mean and standard deviation of the selected variables, descriptive statistics were employed. In order to find out the effects of yoga on lipid profiles of elder women with type 2 diabetes mellitus, the Analysis of Covariance (ANCOVA) was used and the F-ratio was found out. Whenever the F-ratio was found significant, Least Significant Difference (LSD) post hoc testapplied to determine which of the paired means difference was significant. In all the cases 0.05 levels of significance were fixed.

Results

From the Table 2, using ANCOVA, the F ratio for adjusted post-test means in Fasting Plasma Glucose (FPG) and Post-Prandial Blood Sugar (PPBS) of the subjects were 4.17 and 7.56 respectively, which were significant at 0.05 levels. From the Table 4, using ANCOVA, the F ratio for adjusted post-test means in Total Cholesterol (TC), Triglycerides (TG), Low-Density Lipoprotein (LDL), Very Low-Density Lipoprotein (VLDL), High-Density Lipoprotein(HDL) of the subjects were 21.85, 16.17, 18.22, 8.12, 20.53 respectively, which were significant at 0.05 levels. The above analysis of the data indicated that there were a significant difference in the adjusted post-test means among yogic practice group and control group. Further, to determine which of the paired means had a significant difference, the LSD post hoc test was applied and the result was presented in Table 3 and in Table 5. The adjusted post test mean values of blood sugar and five lipid profiles for yogic practice group and control group was graphically represented in the Figure 1 and 2 respectively.

Discussion

Present study was undertaken to find out the effect of yogic intervention on blood sugar and lipid profile in elder women. The results show that following 12 weeks of yogic intervention significant ($p \leq 0.05$) decrease in FPG and PPBG (Table 2 and Figure 1) values in yogic practice group. Similar findings were found by Vaishali [17], Malhotra [18], Savita [19], Upadhyay [20].The exact mechanisms of yogic intervention in decreasing the blood sugar are still unknown. The

	Adjusted Post-test Means		Mean Differences	Standard Error
	YPG	CG		
TC	200.86	206.06	-5.20*	0.733
TG	157.45	162.76	-5.31*	0.727
LDL	123.23	126.94	-3.71*	0.512
VLDL	32.48	34.56	-2.08*	0.519
HDL	51.35	47.64	3.71*	0.570
* Significant at the 0.05 level				

Table 5: LSD test for the differences between the adjusted post- tests paired means of lipid profiles.

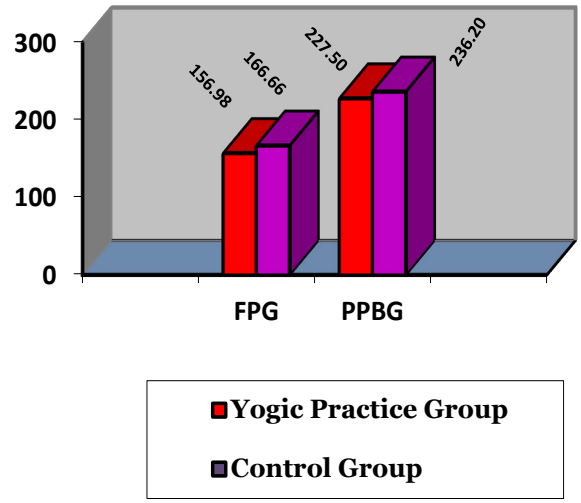

Figure 1: Adjusted post-test mean values of blood sugar of yogic practice group and control group.

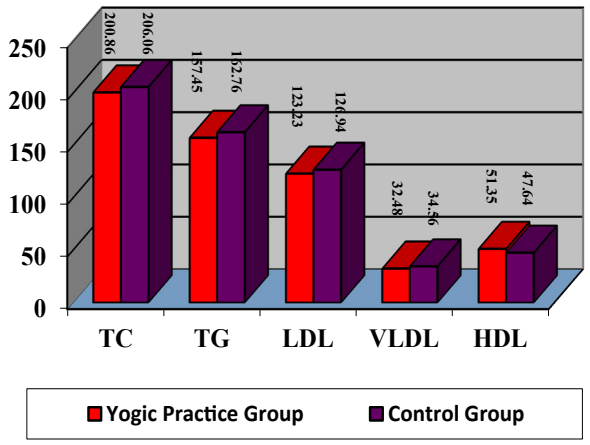

Figure 2: Adjusted post-test mean values of lipid profiles of yogic practice group and control group.

possible mechanisms are (A) Various yogic intervention 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 [21]. (B) Muscular relaxation, development and improved blood supply to muscles might enhance insulin receptor expression on muscles causing increased glucose uptake by muscles and thus reducing blood sugar [22].

The significant ($p \leq 0.05$) decreases in TC, TG, LDL and VLDL values coupled with significant ($p \leq 0.05$) increase in HDL (Table 4 and Figure 2) in our participants imply an improved lipid profile having good prognostic value. This decrease of 'bad' cholesterol and a concomitant increase in 'good' cholesterol has significance when viewed in light of the cardiovascular risk profile of diabetic patients [23]. It has been previously reported that hatha yoga exercise and conventional PT exercise may have preventative and protective effects on diabetes mellitus by decreasing oxidative stress and improving antioxidant status [15]. A similar mechanism may be working in our patients as a systematic review also found the effects of yoga training to be more prominent with regard to fasting blood glucose level and lipid profile [24]. Innes and Vincent [23] reviewed 12 studies and reported that yoga improves lipid profile. Reductions in TC, TG, and LDL, VLDL and increase in HDL in our subjects are comparable with the findings of their review.

The decrease in lipid profile seen in this study is in agreement with the earlier studies. Sahay [25] and Bijlani et al. [26] reported a significant reduction in free fatty acids, LDL, VLDL and an increase in HDL. 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 [4,27]. These changes suggest improvement in the insulin sensitivity following yogic exercises.

In all of mentioned studies, the researcher has tried to evaluate the effect of yoga on blood sugar and lipid profile levels in elderly women along with other risk factors. Despite minor differences in the number of samples, time of exercise and the individual characteristics of the subjects, their results were consistent with the results of this study.

Conclusion

Based on our results, it can be said that, yoga is a non-drug, non-invasive and cost-effective method to improve the quality of life. From the beneficial effects of yoga as seen in this study, it may be assumed that adoption of yoga on long term basis would bring proper control of blood sugar and lipid profile levels in elderly women. However, the sample size is too small, further extensive, large scale and long term studies need to be done to prove this and to understand the basic mechanisms involved.

Acknowledgment

The authors are thankful to the subjects without whose active cooperation the work would not have been completed.

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