International Multidisciplinary Research Journal 2012, 2(8):27-31
ISSN: 2231-6302
Available Online: http://irjs.info/

INTERNATIONAL MULTIDISCIPLINARY RESEARCH JOURNAL

Management of elevated liver enzymes in geriatric diabetes by yogic practice

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Abstract

Objects: The liver plays a major role in the pathogenesis of type 2 diabetes. Moderately elevated liver enzymes are found in type 2 diabetes. This study is designed to appraise the role of yoga on liver enzymes in geriatric type 2 diabetes and consequently, the study constantly monitored the improvement related to glycaemic control during the period of observation.

Study design: A total number of 143 type 2 diabetes patients in an age group of 60-70 years with a history of diabetes for 5-10 years and having poor glycaemic control (HbA_{1c} > 8 %) residing in Kozhikode district, Kerala, India participated in this study in test and control group together. The subjects were divided into three groups according to their glycaemic control: group I with HbA_{1c} 8.6 – 9.7 %, group II with HbA_{1c} 9.8 – 10.7 % and group III with HbA_{1c} 10.8 – 12.7 %. The yogic practice sessions for the test group lasted for three months for 90 minutes a day, 6 days a week, under the guidance and supervision of experienced trainers. Each session was systematically divided into structural components with 15 minutes of *pranayamas* (breath controlling exercises), 10 minutes of warm up exrcises, 50 minutes of *asanas* (yogic postures) and 15 minutes of supine relaxation in *savasana.* The control group, mean while, were asked to continue their routine activities like walking and other normal non specific exercises. Glucose, HbA_{1c}, aspartate aminotransferase, alanine aminotransferase and γ- glutamyl transpeptidase were estimated on base line and after 90 days of all the participants.

Results: The participants in the test group showed statistically significant ($p<0.001$) decrease in glucose, HbA_{1c}, and activity of liver enzymes after yogic practice.

Conclusions: After 90 days of yogic practices, significant reduction in the liver enzymes was achieved in test group, corresponding to the reduction in blood glucose and HbA_{1c} levels. The findings of this study demonstrate the efficacy of yogic practice, as a therapeutic, preventative and protective agent in geriatric type 2 diabetes mellitus by normalizing the liver function tests along with betterment in their glycaemic condition.

Keywords: Geriatric, Yogic practice, Liver enzymes.

INTRODUCTION

Individuals with type 2 diabetes have a higher incidence of liver function test abnormalities than individuals who do not have diabetes. Mild chronic elevations of transaminases often reflect underlying insulin resistance. The liver plays a major role in the pathogenesis of type 2 diabetes. Increased activities of liver enzymes such as aspartate aminotransferase (AST), alanine aminotransferase (ALT) and γ-glutamyl transpeptidase (GGT) are indicators of hepatocellular injury. Increased activity of these markers is associated with insulin resistance[1], metabolic syndrome and type 2 diabetes.[2, 3] A limited number of prospective studies have found that high activities of AST, ALT and GGT are associated with the occurrence of type 2 diabetes, irrespective of age.[4]

The prevalence of type 2 diabetes is increasing all over the world. This trend is visible both in developed and in developing countries. According to the Diabetic Atlas 2009, published by the International Diabetic Federation, the prevalence of type 2 diabetes in Indian population is estimated to be around 51 million, bestowing the country with the title "diabetic capital of the world".[5] Diabetes Mellitus is a slowly progressive disease, affecting most of the systems in the body and perpetually deteriorating their normal functions. The chronological age of 65 years as a definition of "elderly" has been accepted by most developed countries in the world. In the year 2002, the number of elderly people in India was about 75 million and it is projected to rise to 9 % of the total population by 2016. From the global perspective, the elderly will constitute one third of the total population of the world by 2050. Health economic models have suggested that benefits of treating glycaemia may be somewhat less in older, than in younger patients.[6] Clearly, there is a need for cost-effective prevention and management strategies for type 2 diabetes that address the multiple interrelated factors underlying this complex, devastating and increasingly common disorder. Interest in and the use of complementary and alternative medicine has recently expanded in many countries around the world. Through the use of complementary therapies, diabetes patients can be alleviated from complications due to the chronic course of the disease, the debilitation of complications and threat of death, as well as the complexities of treatment plans.[7] Of particular interest in this regard is yoga, an ancient mind–body discipline, originated in India over 4000 years ago. Yoga has been widely used in India for the management of diabetes, hypertension and related chronic insulin resistance conditions. The practice of yoga is rising steadily in the United States and other industrialized countries in recent decades.[8] Many studies have proved the effectiveness of yoga. These investigations include a vast range of disorder like cardiovascular disease, hypertension, asthma, immune

Received: June 18, 2012; Revised: July 19, 2012; Accepted: Aug 25, 2012.

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conditions and diabetes. A few studies have examined the effect of yoga on insulin and glucoregulatory hormones.[9] In this study we evaluated the effects of yoga on liver enzymes in individuals with type 2 diabetes mellitus. The study also monitored the improvement related to glycaemic control in the same time period.

MATERIALS AND METHODS

Yoga has been traditionally considered to be an all in one remedy for many ailments including chronic ones. This study was aimed at identifying a scientific base for the centuries old culture prevalent in many parts of India as well as in foreign countries. This study was carried out for a period of more than one year, to be accurate, from March 2009 to December 2010. This study was carried out among the patients who visited the Diabetology department of Malabar Institute of Medical Science, Kozhikode, Kerala, India followed by news paper advertisement. Many patients willfully turned out to be volunteers for the study. A total number of 143 patients, all of them are elderly, healthy and within the age group of 60 to 70 years were analyzed. All of them were suffering from type 2 diabetes mellitus, with a history of 5 to 10 years and having poor glycaemic control (HbA_{1c} > 8 %) residing in Kozhikode District. The family background of all the patients was similar-they all belongs to the middle class and were literate. Interestingly, all the 143 patients were non-vegetarian with similar food habits and diet patterns. They were asked to make no changes in their life style. Consequently they maintained the same food habits throughout the study. All these volunteers consumed their regular medicines in same doses during the entire period of the study. The demographic characteristics are reported in Table 1. Those volunteers who were clinically diagnosed with complications like coronary artery disease, renal disease and malignancies were not included in the project. Patients co-operated in the study were informed prior to the project, thereby obtaining consent from them. The institutional ethics committee had also given green signal for the project.

The project started with an awareness program, informing patients the importance and health benefits of yoga in day to day life. Those who were interested in yogic practice joined in the test group and others remained as controls. Seventy three patients who joined in the test group, practiced yoga in Yogabharathy Yoga Centre, Vadakara, Kozhikode District. The sessions lasted for three months, 90 minutes a day, 6 days a week, under the guidance and supervision of experienced trainers. The sessions were carried out in a meticulous way, with each individual getting personal attention during the entire period. Each session was systematically divided into structural components with 15 minutes of *pranayamas* (breath controlling exercises), 10 minutes of warm up exercises, 50 minutes of *asanas* (yogic postures) and 15 minutes of supine relaxation in *savasana*.

Meanwhile, seventy patients in the control group were asked to continue their routine activities like walking and other normal non specific exercises. This control group was also asked not to begin any new activity during the phase of the study. The total patients were again subdivided into three groups according to their HbA_{1c} value. Group 1 with HbA_{1c} 8.6 – 9.7 %, group II with 9.8 – 10.7 % and group III with 10.8 – 12.7 %. Fasting blood glucose, HbA_{1c}, AST, ALT, GGT (Siemens Dimension clinical chemistry analyzer, USA) and HbA_{1c} (Bio-rad D 10 analyzer, USA) were assessed initially and after 90 days of all the participants. All estimates were presented as mean +/- SE. The volunteers were not given any information about the fact that they are being part of a project comparing them with a control group. Both the volunteers as well as the trainers were blind to the data analysis.

Statistical analysis

The normality of the variables considered was tested using Kolmogorov - Smirnov test and we found that HbA_{1c} and glucose were following the normal distribution and the liver enzymes were not following the normal distribution. So, we tested the effect of yogic practice on the levels of liver enzymes using Wilcoxon Signed Rank test and paired *t*- test for HbA_{1c} and glucose. The difference between the levels of control and test group at base line values of liver enzymes were analyzed by Mann – Whitney Test and independent sample *t*- test for HbA_{1c} and glucose. SPSS 16.0 program and Microsoft Excel 2003 were used to perform statistical analysis. Level of significance was set at $p<0.05$.

Table 1. Demographic characteristics of participants (Mean ± SD).

	Test group	Control group	*p* value
Number	73	70	
Age (Years) (Male/Female)	64 ± 4 (47/26)	62 ± 3.4 (41/29)	0.001
Duration of diabetes (Years)	8 ± 2	8 ± 2	1.00
BMI (kg/m^2)	25.3 ± 3.2	25 ± 4.1	0.626
Weight (kg)	68.2 ± 3.4	67.4 ± 4.2	0.214

Table 2. HbA_{1c} and glucose values before and after yogic practice of test group comparing with control in groups I, II & III.

		HbA_{1c} (%)				Glucose (mg/dl)			
	No	Before	After	*p* value	% change after yoga	Before	After	*P* value	% change after yoga
Group I	37	9.27 ± 0.049	9.36±0.057	0.005*	11	148.46±2.08	150.97±2.28	0.05 *	22
Control	33	9.40 ± 0.050	8.36±0.05	0.000**		179.7±6.23	140±6.02	0.000**	
Test		*p*=0.075†				*p* =0.000			
Group II	21	10.17±0.063	10.31±0.08	0.000*	12	179.81±6.63	183.71±6.89	0.036 *	20
Control	26	10.17±0.046	38.9±0.048	0.000**		184.12±7.07	146.81±5.53	0.000**	
Test		*p*=0.983†				*p* =0.659 †			
Group III	12	11.48±0.187	11.8±0.178	0.000*	12.2	235±11.57	235.33±10.76	0.922‡	19
Control	14	11.22±0.069	10 ± 0.086	0.00 **		176.93 ± 8.7	142.21 ± 7.93	0.000**	
Test		*p*=0.223†				*p* = 0.001			

Values represent Mean ± SE.,† No significant difference in the initial readings of control and test, * Significant Increase ** Significant Decreasem ‡ Not significantly changed.

Table 3. Comparison of liver enzyme values before and after yogic practice of test group with control in groups I, II & III.

	AST			ALT			GGT		
	Before	**After**	***p* value**	**Before**	**After**	***p* value**	**Before**	**After**	***p* value**
Group I Control Test	41.68 ± 3.87 51.61 ± 4.52 *p*=0.022	43.38 ± 4.31 35.3 ± 2.27	0.069‡ 0.000**	69.46 ± 4.3 82.79 ± 7.23 *p*=0.118†	72.92 ± 5 58.79 ± 3.64	0.006* 0.000**	70.68 ± 5.83 84.24 ± 11.46 *p*=0.430†	72.92 ± 6.13 57.55 ± 6.18	0.002* 0.000**
Group II Control Test	50.52 ± 7.8 52.77 ± 3.62 *p*=0.101†	52.14 ± 8.1 36.41 ± 2.55	0.082‡ 0.000**	73.14 ± 9.6 77.88 ± 4.81 *p* =0.042	76.95 ± 9.95 56.92 ± 2.67	0.005* 0.000**	54.38 ± 3.56 68.73 ± 5.39 *p* =0.036	55.52 ± 3.95 49.81 ± 3.69	0.255‡ 0.000**
Group III Control Test	31.17 ± 1.14 43.36 ± 3.24 *p* =0.007	30.33 ± 1.1 31.5 ± 1.65	0.592‡ 0.001**	55.58 ± 2.59 68.93 ± 5.05 *p* =0.053†	55.58 ± 3.51 52.14 ± 2.77	0.720‡ 0.001**	60.42 ± 3.2 72.5 ± 5.32 *p* =0.085†	62.42 ± 3.56 58.57 ± 4.01	0.049* 0.001**

Values represent Mean ± SE. † No significant difference in the initial readings of control and test * Significant Increase ** Significant Decrease ‡ Not significantly changed.

Table 4. Change in liver enzymes (in percentage) after yogic practice in test groups.

Variable	Group I	Group II	Group III
AST	31.6	31	27.3
ALT	28.9	26.9	24.3
GGT	31.6	27.5	19.2

RESULTS

Out of the 143 geriatric type 2 diabetic patients, 61.5 % were males and 38.5 % females. Subjects were matched according to age and gender. The mean age was similar in control and test groups. They were also similar in body weight and body mass index (Table 1). All the 143 patients completed the study by participating in the three months' assessment period. Significant decrease (p =0.000) was observed for HbA_{1c} after 3 months of yogic practice in test group I (9.40 ± 0.050 to 8.36 ± 0.05 %), group II (10.17 ± 0.046 to 8.9 ± 0.048 %) and group III (11.22 ± 0.069 to 10 ± 0.086 %). In contrast to this, a significant increase with p=0.005 in control group I (9.27 ± 0.049 to 9.36 ± 0.057 %), p=0.000 in control group II (10.17 ± 0.063 to 10.31 ± 0.083 %) and p=0.000 in control group III (11.48 ± 0.187 to 11.80 ± 0.178 %) was observed. The percentage reduction in HbA_{1c} of test group I, II & III was 11.0, 12.0 and 12.2 respectively (Table 2). There was also a significant decrease (p =0.000) observed in the test group for fasting glucose. For glucose in test group I the values decreased from 179.7 ± 6.23 mg/dl to 140 ± 6.02 mg/dl (20 %), in test group II the decrease was from 184.12 ± 7.07 mg/dl to 146.81 ± 5.53 mg/dl (20 %) and in test group III the decrease was from 176.93 ± 8.7 mg/dl to 142.21 ± 7.93 mg/dl (19 %). At the same time in control group I a significant increase (p=0.005) from 148 ± 2.08 to 150.97 ± 2.28 mg/dl and in control group II a significant increase (p=0.036) from 179.81 ± 6.63 to 183.71 ± 6.89 mg/dl were observed. No significant change was observed in control group III.

In the case of liver enzymes, for AST in test group I, the values significantly decreased (p=0.000) from 51.61 ± 4.52 to 35.3 ±2.27 IU/L and the % change after yogic practice was 31.6. In test group II, the values decreased significantly (p= 0.000) from 52.77 ± 3.62 to 36.41 ± 2.55 IU/L and the change was 31 %. In test group III, a significant decrease was observed (p= 0.001) from 43.36 ± 3.24 to 31.5 ± 1.65 IU/L and the % change was 27.3 and there was no significant change observed in the control groups (Table 3). For ALT in test group I, the values significantly decreased (p=0.000) from 82.79 ± 7.23 to 58.79 ± 3.64 IU/L and the % change after yogic practice was 28.9. At the same time in control group I, a significant increase was observed (p = 0.006) from 69.46 ± 4.3 to 72.92 ± 5 IU/L. In test group II, there was a significant decrease (p = 0.000) from 77.88 ± 4.81 to 56.92 ± 2.67 IU/L and the % change was 26.9. As in control group I, a significant increase (p = 0.005) from 73.14 ± 9.6 to 76.95 ± 9.95 IU/L was observed in control group II also. In test group III, a significant decrease was observed (p=0.001) from 68.93 ± 5.05 to 52.14 ± 2.77 IU/L and 24.3 % of change was observed in values and without a significant change in control group III (Table 3). In test group I, the GGT values significantly decreased (p=0.000) from 84.24 ± 11.46 to 57.55 ± 6.18 IU/L and the % change was 31.6 and in control group I, a significant increase was observed (p = 0.002) from 70.68 ± 5.83 to 72.92 ± 6.13 IU/L. In test group II, the values decreased significantly (p= 0.000) from 68.73 ± 5.39 to 49.81 ± 3.95 IU/L and the change was 27.5 %. No significant change was observed in the control values. In test group III, a significant decrease (p=0.001) from 72.5 ± 5.32 to 58.57 ± 4.01 IU/L and 19.2 % of change was observed in the values. In control group III, an increase from 60.42 ± 3.2 to 62.42 ± 3.56 IU/L was observed at p value 0.049 (Table 3).

DISCUSSION

Following 90 days of yogic practice, a significant reduction in the liver enzymes was achieved in test group. In the test group, before yogic practice, 64 % participants had elevated AST. ALT was elevated in 59 % and GGT in 19 %. Ayman *et al.,* (2011) reported significant increase in liver enzymes of type 2 Sudanese diabetic patients.[10] Studies regarding the effect of yogic practice on liver enzymes in type 2 diabetes are not reported. The relationship between exercise and liver health is also not so clear. A strong protective effect of physical activity on the risk of diabetes promotion and the regular physical activity prevent diabetes and cardiovascular disease in high-risk populations and also appears to be slightly protective against raised GGT level.[11]

Yoga's approach to fitness is that it does not merely focus on visible physical health, but on the body as a whole. This means that it takes into account the relationship between physical, mental and emotional health and the need to maintain a proper balance in totality. Yoga, therefore acts as a balancing force, through its combination of physical postures, breathing techniques and meditation.[12] Many of the yoga postures put gentle pressure or act as a massage on the internal organs, thereby stimulating it. Some postures improve circulation and some improve nervous system function.[13] Breath exercises also improve circulation and cleanse the

system.[14] Thus they indirectly improve liver function by balancing the various functions that do have an effect on liver function.

Various yoga-*asanas* may be directly rejuvenating the cells of pancreas as a result of which there may be an increase in the utilization and metabolism of glucose in the peripheral tissues, liver and adipose tissues through enzymatic processes[15]. A decrease in the drug requirements by some of the patients have also been reported.[16] As the beneficial changes observed in the liver enzymes in this study, other several risk indices, including glucose tolerance and insulin sensitivity, lipid profiles, anthropometric characteristics, blood pressure, oxidative stress, coagulation profiles, sympathetic activation and pulmonary function, as well as improvement in specific clinical outcomes were also observed.[8]

Yogic practice with its change in posture and controlled breathing influences mental status of an individual, allaying apprehension, stress and brings about feelings of well being and hormonal balance. Sense of well being seen in those practicing yoga is also believed to be due to the endogenous secretion of melatonin.[17] Thus, it is not wrong to conclude that diabetes can be better controlled if yoga can also be simultaneously practiced along with conventional medicines.

From the group comparison, it was clear that the effect of yogic practice on liver enzymes was directly related to the glycaemic control in geriatric patients (Table 4). From this study, we observed that along with the improvement in glycaemic status, liver function also fell into normal level. The impact of yogic practice was more visible for the group with better glycaemic control, *ie*., group I. From this we may conclude that with yogic practice alone, maximal benefits could be seen in patients with mild cases of diabetes. These findings demonstrate the efficacy of yogic practice, as a therapeutic, preventative and protective agent in geriatric type 2 diabetes mellitus by normalizing the liver functions along with balancing the glycaemic condition. The major limitation of the present study according to the authors is that the subjects could not be kept under uniform, identical study environment. This is because all the subjects were staying in their homes with their families. Strict adherence to medication was another aspect. Subjects were regular in this respect was assumed, but could not be objectively verified. Changes in food habits might also have influenced the results, as the study was essentially on diabetic patients.

ACKNOWLEDGEMENTS

The authors are thankful to the participants without whose cooperation the work could not have been completed.

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