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Research Article

Effect of Yoga training on MDA and Blood Thiol levels in Healthy Volunteers

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Abstract: Yoga is an ancient Indian practice that is believed to lead to a state of total health. It includes meditation, relaxation, control of breathing, and various physical postures (asanas). A study was designed to assess the effect of yoga training on plasma MDA levels and blood thiol levels in healthy volunteers (n=100) and was compared with a group of normal healthy controls (n=100). The experimental group was further subdivided into two groups, i.e. as group A (in the age group of 20-35 years) and group B (age 36-50 years) with equal participants in each group. Blood samples were taken before starting the yoga training (baseline) and after 40 and 90 days. Plasma malonyldialdehyde (MDA) level was found to be significantly reduced ($p < 0.001$) and blood thiol level was raised significantly ($p < 0.001$) after 40 days. Similarly, the changes in the both parameters were highly significant even after 90 days. Reduction in oxidative stress suggests that yoga training appears to be effective in reducing stress and improving health.

Keywords: *MDA, Blood Thiol, Yoga training, Lipid Peroxidation, Oxidative Stress*.

INTRODUCTION

In this age of technology, industrialization and urbanization, everyone is constantly subjected to tremendous stress and tension. These, in turn, produce psychosomatic diseases like hypertension, insomnia and heart problems. Modern medicine is very effective in controlling infections, performing surgeries and managing diseases. However, it has limited role in stress based, chronic degenerative, old age and lifestyle related disorders which are the bane of modern society.

Yoga is a Sanskrit word which means union and is interpreted that union with the divine (Stuart, R.S. 2005). It is a generic term for the physical, mental and spiritual practices or disciplines, which originated in ancient India with a view to attain a state of permanent peace (Bryant Edwin. 2009). Healthy life is considered to be a by-product of practicing meditation and yogic techniques since it has been observed that yoga practitioners are physically and mentally healthier and have better coping skills to stressors than the normal population. Although there are many types of yoga practices, yoga typically combines stretching exercises and different poses with deep breathing and meditation. It is designed to stretch and tone the muscles and to keep the spine and joint flexible. Some suggest that the bending, twisting and stretching movements also massage the internal organs and glands. Yoga poses are generally done with deep, diaphragmatic breathing that is thought to increase oxygen flow to the brain (Tiffany, F. 2011).

The present study was designed to investigate the effect of yogic asanas on oxidative stress and antioxidatant status in two age groups *i. e.* 20-35 years and 36-50 years in subjects performing the above practices for short term (40 days) and long term (90 days).

MATERIAL AND METHODS

This study was conducted in 200 healthy male volunteers, in the age group of 20 to 50 years, in Department of Biochemistry, Maharaja Agrasen Medical College (M.A.M.C), Agroha, and Hisar. Two hundred healthy male volunteers were divided into two groups as given below

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Group-I –which included 100 volunteers as control subjects who led their normal life without doing any yoga, meditation or exercise (n=100).

Group-II- which included 100 volunteers who started practicing yoga (consisting of various activity *i.e. warm-up, supine asanas, sitting asanas, prone asanas, standing asanas* and followed by *pranayama*, concentration and relaxation). These *asanas* were taught by a yoga expert; they were initially called continuously for five days and then once every week for follow up and compliance. Total time for performing yoga being 45 minutes every day for ninety days.

Each group was further sub-divided into two categories, according to their age

Sub- groups "A" - 50 volunteers having age in the rangeof 20 to 35 years.

Sub- group "B"- 50 volunteers having age in the range of 36 to 50 years.

For comparison, the subjects of the two age groups were put together in group C, which included all the 100 volunteers in the range of 20 to 50 years of age.

The project was reviewed and approved by the Institutional Ethics Committee. All subjects were explained about the study undertaken and informed written consent was obtained. These subjects were given a questionnaire and personal data form, which they were required to fill up with certain details like their dietary habits, extent of physical activity and family history. Subjects were asked to avoid food, tea, coffee, nicotine at least two hour prior to testing. The whole procedure was explained in detail to each subject in order to alley any fear or apprehension. The basic parameters like age, weight and height were measured and recorded in specific proforma.

Exclusion Criteria

Subjects having previous experience of yoga or sports training and suffering from any acute or chronic disease, chronic smoker, chronic alcoholics and subjects taking any vitamin or anabolic supplement were excluded.

Biochemical Parameters Studied

Firstly, a baseline fasting venous blood sample (approx. 7 ml) was collected from all subjects before starting the brisk walking under the study. After starting the brisk walking, two more samples were collected after 40 days and 90 days. The volunteers were assessed for MDA and blood thiol levels.

Malonyldialdehyde (MDA)- was estimated by Buege‟s method. In this method, the product of lipid peroxidation i.e. MDA reacts with thiobarbituric acid (TBA) to give a red chromogen, the absorbance of which is read at 535 nm (Kumar *et al.*, 1995).

Total Thiols- was estimated by Ellman‟s method, in this method, 5-5 dithiobis-2-nitrobenzoic acid reacts with total sulphydryl groups to form a chromogen whose extinction is measured at 420 nm (Ellman, G.L. 1959).

Statistical Analysis

The data was recorded; mean and standard deviation were calculated for each group. Results were statistically analyzed by Student‟s t- test. Paired„t‟ test was used for inter group comparisons. Analysis of variance was done to see if the group differs in any of the parameters. The interpretation of „P‟ values was as follows: P>0.05 - not significant, P<0.05 – Significant <0.01 - Highly significant, P<.001 – Very highly significant.

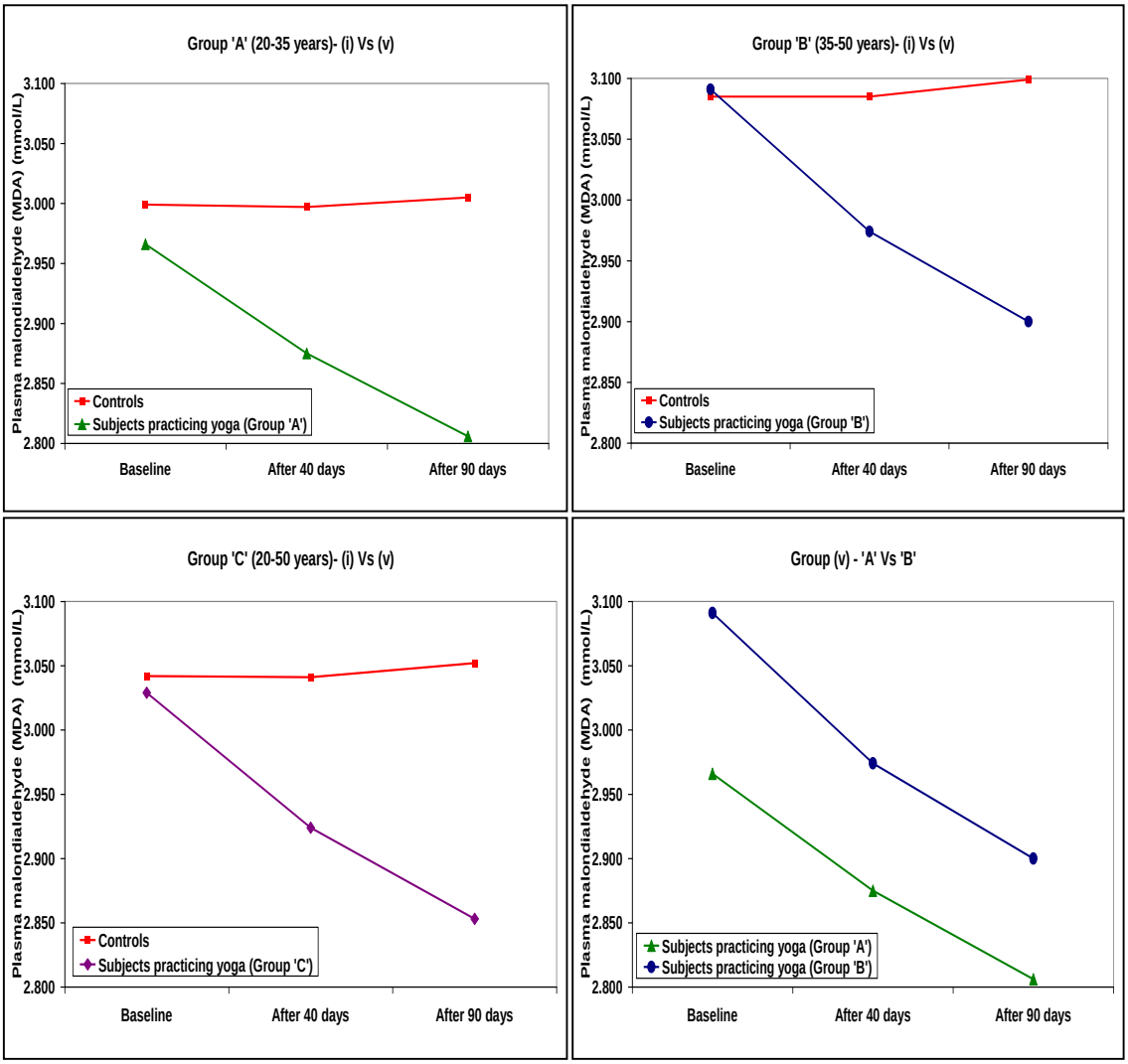
RESULTS

Data is depicted in Table 1 and Table 2. Both parameters were comparable in control subjects and subjects practicing yoga of each age group.

Table 1: Plasma malondialdehyde (MDA) concentration (mmol/L) in controls and subjects practicing yoga (values are mean ± S.D)

Groups	Control subjects (i)			Subjects practicing yoga (v)		
	Baseline	After 40 days	After 90 days	Baseline	After 40 days	After 90 days
A (20-35 years) n=50	2.999 ± 0.115	2.997 ± 0.128	3.005 ± 0.131	2.966 ± 0.109	2.875 ± 0.108*	2.806± 0.116*
B (36-50 years) n=50	3.085 ± 0.112	3.085 ± 0.127	3.099 ± 0.133	3.091 ± 0.131	2.974 ± 0.115*	2.900 ± 0.130*
C (20-50 years) n= 100	3.042 ± 0.121	3.041 ± 0.135	3.052 ± 0.140	3.029 ± 0.135	2.924 ± 0.121*	2.853 ± 0.131*

*p<0.001 when compared with the baseline value



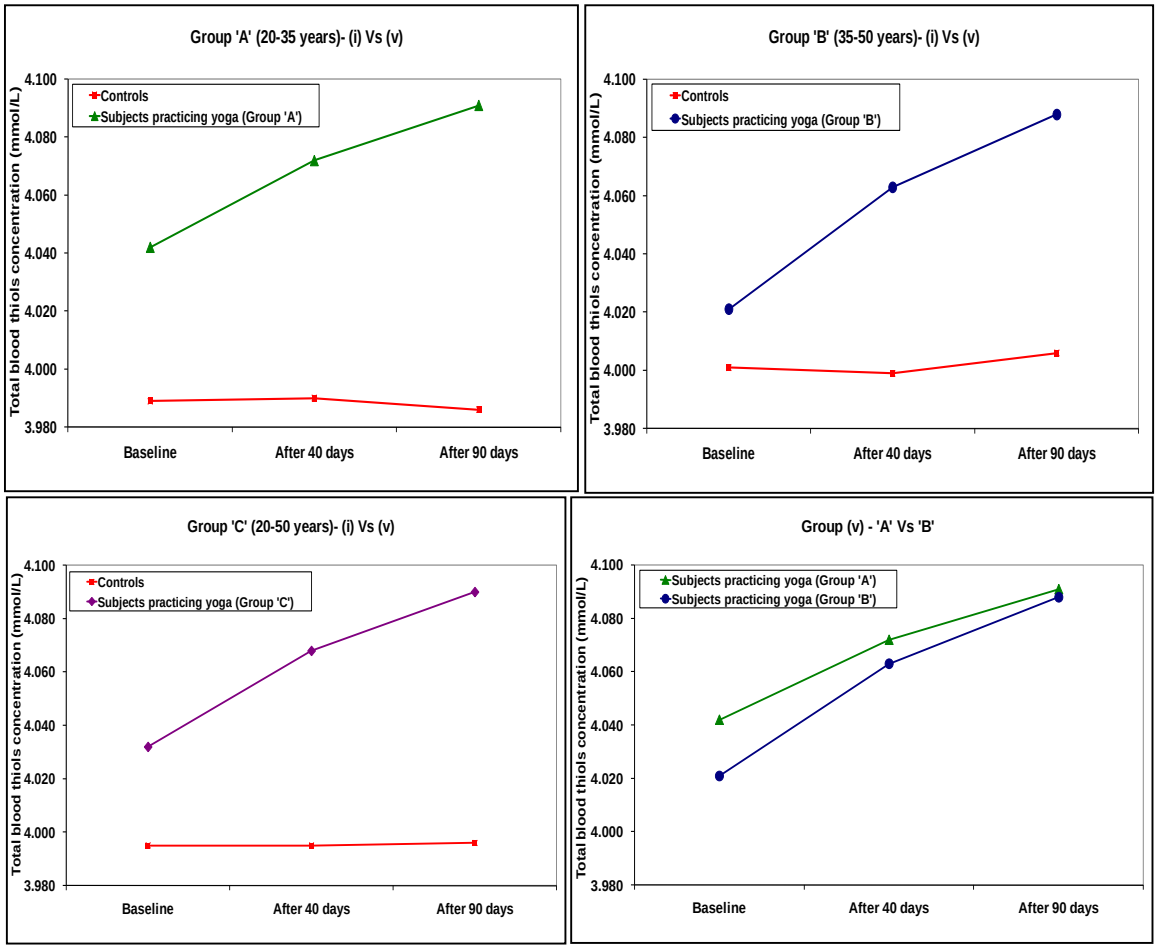
Group (i): Control subjects **Group (ii): Subjects undergoing yoga**
Sub-group (A): 20-35 years **Sub-group (B): 36-50 years** **Sub-group (C): 20-50 years**

Fig. 1: Alterations in mean plasma malondialdehyde (MDA) concentration (mmol/L) insubjects undergoing yoga

Table 2: Total blood thiols concentration (mmol/L) in controls and subjects practicing yoga (values are mean ± S.D)

Groups	Control subjects (i)			Subjects practicing yoga (v)		
	Baseline	After 40 days	After 90 days	Baseline	After 40 days	After 90 days
A (20-35 years) n=50	3.989 ± 0.166	3.990 ± 0.165	3.986 ± 0.176	4.042 ± 0.179	4.072 ± 0.180*	4.091 ± 0.187*
B (36-50 years) n=50	4.001 ± 0.177	3.999 ± 0.178	4.006 ± 0.182	4.021 ± 0.171	4.063 ± 0.180*	4.088 ± 0.170*
C (20-50 years) n= 100	3.995 ± 0.171	3.995 ± 0.171	3.996 ± 0.178	4.032 ± 0.175	4.068 ± 0.180*	4.090 ± 0.178*

*p<0.001 when compared with the baseline value



Group (i): Control subjects **Group (ii): Subjects undergoing yoga**
Sub-group (A): 20-35 years **Sub-group (B): 36-50 years** **Sub-group (C): 20-50 years**

Fig. 2: Alterations in mean total blood thiols concentration (mmol/L) in subjects undergoing yoga

In present study the changes in the mean baseline plasma MDA concentrations in control subjects in age Group A (20-35 years) and Group B (36-50 years) after the follow-up period of 90 days was not statistically significant.

In subjects practicing yoga, age Group A (20-35 years) and age Group B (36-50 years) the mean baseline plasma MDA concentration was decreased significantly on day 40 as well as on day 90 of practicing yoga.

The change in the mean baseline MDA concentration in control subjects of age Group C (20-50 years) after the follow-up period of 90 days was not statistically significant. In all the subjects practicing yoga, age Group C (20-50 years) the mean baseline MDA concentration was significantly decreased on day 40 and on day 90 of practicing yoga. (Table 1 & Fig. 1).

The change in the mean total blood thiols concentration in control subjects of age Group A (20-35 years) after the follow-up period of 90 days was not statistically significant.

In subjects practicing yoga, age Group A (20-35years) the mean baseline total blood thiols concentration was increased on day 40 and on day 90.The change in the mean baseline total blood thiols concentration in control subjects of age Group B (36-50 years) after the follow-up period of 90 days was not statistically significant. In subjects practicing yoga, age Group B (36-50 years) the mean baseline total blood thiols concentration was significantly increased to on day 40 and on day 90.

The change in the mean baseline total blood thiols concentration in all the control subjects of age Group C (20-50 years) after the follow-up period of 90 days was not statistically significant. In all the subjects practicing yoga, age Group C (20-50 years) the mean baseline total blood thiols concentration was significantly increased on day 40 and on day 90 (Table 2 & Fig. 2).

DISCUSSION

Subjects practicing yoga showed a significant reduction in serum MDA concentration and a concomitant rise in total blood thiols level up to 90 days when compared to the control group. Differences were nearly same in the two age groups.

The beneficial effects of meditation and meditative movement on physical body have been revealed by several workers. There are reports suggesting that meditation enhances parasympathetic nervous system, cerebral blood flow, cerebral function of attention areas and release of dopamine and serotonin (Wu, S.D., & Lo, P.C. 2008; Khalsa, D.S. *et al.,* 2009; Chiesa, A. 2010). Additionally, clinical studies have illustrated its therapeutic effects in many pathological diseases when used in combination with conventional treatment such as cancer (Biegler, K.A. *et al.,* 2009), cardiovascular diseases (Lan, C. *et al.,* 2008; Olivo, E. L. *et al.,* 2009), diabetes mellitus (Rosenzweig, S. *et al.,* 2007), hypertension (Anderson, J. W. *et al.,* 2008), and chronic pain (Teixeira, M.E. 2008). However, various biochemical parameters and cellular and molecular mechanism still have to be answered in healthy individuals.

Santha Joseph *et al.,* evaluated the effect of yogic training in healthy subjects and reported a significant reduction in blood glucose level after three months (Joseph, S. *et al.,* 1981). Chatterjee *et al.,* also observed the impact of regular practice of yoga and reported a significant reduction in fasting blood sugar after six weeks (Chatterjee, S. *et al.,* 2011). The response of yoga has also been observed by various workers in diabetics. Jain *et al.,* studied the effect of 40 days of yoga therapy on NIDDM and reported a significant reduction in hyperglycemia (Jain, S. C. *et al.,* 1993). Damodaran *et al.,* observed a significant decrease in blood glucose level in patients with mild to moderate essential hypertension after three months of yogic practices (Damodaran, A. *et al.,* 2002). Patients with NIDDM also showed a significant decrease in fasting as well as postprandial blood glucose levels and glycosylated-Hb concentration after 40 days of training in yoga asanas (Malhotra, V. *et al.,* 2010). Malhotra *et al.,* suggested that better glycaemic control can be obtained in NIDDM cases with yoga asana and pranayama (Malhotra, V. *et al.,* 2002). They further reported that patients of type 2 diabetes mellitus with long term history, performing yoga asanas in addition to normal medical therapy, perform better in terms of the use of less medicine, improvement of physical well being and mental alertness (Malhotra, V. *et al.,* 2010).

Damodaran *et al.,* studied the effect of yogic practices in middle aged group patients with mild to moderate essential hypertension and reported a significant decrease in serum cholesterol and triglycerides with overall improvement in subjective well-being and quality of life, after three months. They suggested that yoga can play an important role in risk modification for cardiovascular diseases in mild to moderate hypertension (Damodaran, A. *et al.,* 2002). Bijlani *et al.,* studied the short-term impact of a brief lifestyle intervention based on yoga in a heterogeneous group of patients with hypertension, coronary artery disease, diabetes mellitus and other illnesses, and observed a significant reduction in serum total cholesterol, LDL-C, VLDL-C and total triglycerides, and increase in HDL-C after 8-day lifestyle modification programs based on yoga. Changes were more marked in subjects with hypercholesterolemia. They suggested that a short lifestyle modification and stress management program based on yoga leads to favourable metabolic effects (Bijlani, R. L. *et al.,* 2005).

Changes in oxidative stress and antioxidant components observed in the present study, *i.e.* a decrease in MDA with a concomitant rise in total blood thiols after 90 days of practicing yoga, are in agreement the study of Cheong and Lim (Cheong, K. J., & Lim, S. A. 2012). They reported that regular yoga training on the healthy university students decreases serum MDA level with a significant increase in antioxidant components (glutathione and its redox system, total antioxidant capacity, activities of SOD and catalase) after 12 weeks. They suggested that yogic exercise has the utility, as a remedy to control or check oxidative stress in the healthy volunteers. Yadav *et al.,* reported that oxidative stress contributes to the process of aging as well as a variety of chronic degenerative diseases. They studied the effect of a comprehensive yoga-based lifestyle modification program on lipid peroxidation and observed that serum concentration of thiobarbituric acid reactive substances (an indicator of oxidative stress) decreases after 9 day course of practices of yoga (Yadav, R.K. *et al.,* 2005).

There are however, many reports demonstrating the effect of yoga on parameters of oxidative stress and antioxidative status in diabetic patients. Damodaran *et al.,* studied the effect of yogic practices in middle aged group patients in mild to moderate essential hypertension. They reported a significant decrease in MDA level suggesting decreased sympathetic activity and oxidant stress (Damodaran, A. *et al.,* 2002). Jatuporn *et al.,* studied the short-term effects of an intensive lifestyle modification program on lipid peroxidation and antioxidant systems in patients with coronary artery disease. They observed no significant change in plasma MDA while a significant increase in plasma total antioxidants, plasma vitamin E and glutathione level in patients undergoing yoga and medication for four months (Jatuporn, S. *et al.,* 2003). Singh *et al.,* studied the effect of yoga asanas in long term diabetes and reported a significant reduction in MDA after 40 days (Singh, S. *et al.,* 2004). In another study Gordon *et al.,* reported that lipid peroxidation, as indicated by MDA, significantly decreases while the activity of SOD increases in type 2 diabetes mellitus patients performing hatha yoga (Gordon, L. A. *et al.,* 2008). Malhotra *et al.,* also observed a significant decrease in MDA level in patients of type 2 diabetes mellitus after 40 days of yoga asanas (Malhotra, V. *et al.,* 2010). Duraiswamy *et al.,* also reported a significant decrease in MDA level and a rise in serum SOD activity in patients with type 2 diabetes, after 5

weeks of yogic intervention (Duraiswamy, G. *et al.*, 2007).

Reduced levels of serum MDA and an increase antioxidant status imply diminution of oxidative stress and the improvement of antioxidant defense. The oxidative stress is closely linked to the progress of pathogenesis and leads to impairment of homeostasis in human body. MDA, the end product of lipid peroxidation, is formed by reactive oxygen species to defend the body from oxidative stress, may be a well-equipped of the antioxidant system to prevent from harmful oxidative stressors (Lante, A. *et al.*, 2011; Özkaya, D. *et al.*, 2011; Saeaue, L. *et al.*, 2011). Yoga is one of the most popular and efficient exercises for maintaining well-being personal life in the World. Cheong and Lim concluded that regular yoga training efficiently help to strengthen the antioxidant systems and decreases the oxidative stress for maintaining well-being life, and that yoga has protective or therapeutically effects against the oxidative stresses derived diseases (Cheong, K. J., & Lim, S. A. 2012).

CONCLUSION

Regular yoga practice reduces body oxidative stress and helps to maintain normal healthy lifestyle.

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