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Effect of Yoga Practices on HS-CRP in Indian Railway Engine Drivers of Metropolis

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Abstract: *To examine the effect of yoga training on high sensitivity C reactive protein (hs-CRP) and lipid profile levels in railway engine drivers working in metropolis.*
Methods: Male drivers of Indian railways, age ranged from 30 to 42 yrs with no known medical disorders, were randomized to yoga group (n=16) and control group (n=16). At the baseline and after completion of one month yoga training both the groups were assessed for hs-CRP and lipid profile levels. The yoga group practiced in a set of yoga techniques for 1 hr. daily in the morning along with daily routine work, while control group engaged in daily routine work only.
Results: Statistically significant reduction ($p<0.01$) was evident in both hs-CRP and serum total cholesterol.Conclusion: Yoga based lifestyle modifications could contribute to prevention of coronary artery disease.

Key words: *hs-CRP, CAD, Lipid profiles, Yoga, Railway engine drivers.*

Introduction

The process of inflammation is an immunological response evoked by the body injury or infection. The past clinical and population research studies suggest the importance of inflammation in progression of atherosclerosis (*Heinrich, Schulte, Schonfeld, Kohler, Assmann*, 1995). This is the process in which fatty deposits build up in the inner lining of arteries. C-reactive protein is an acute phase protein which increases during systemic inflammation. In fact, it has been found that the *high sensitivity C reactive protein* (hs-CRP) is a reliable indicator of inflammatory atherosclerosis among subjects with or without cardiovascular disease (CVD) (*Tracy, Lemaitre*, *Psaty, Ives, Evans, Cushman, Meilahn, Kuller*, 1997).

There is evidence that physical activity may modify the inflammatory process. In fact, the effect of regular exercise has shown inverse association on levels of inflammatory markers (*Geffken*, *Cushman, Burke, Polak, Sakkinen, Tracy*, 2001). Rohde et al. reported that healthy men who exercise more than one time a week had lower mean CRP than the men who did not exercise at least once a week (*Rohde, Hennekens, Ridker*, 1999). In addition, some of the CVD risk factors, in particular those relating to inflammation and hemostasis, are also modified favorably with physical activity (*Eckel, Barouch, Ershow*, 2002). This likely represents an additional mechanistic pathway through which physical activity decreases CVD risk. Ridker et al. found that aspirin use decreased risk of myocardial infarction and ischemic stroke in apparently healthy men, primarily in those with the highest levels of C-reactive protein (*Ridke,* 1997). This suggests that even a moderate reduction in inflammation may be protective.

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The profession of railway engine driver, especially in metropolitan cities in India, is very hectic and full of uncertainty that influence more stress due to night work and long irregular working hours, which may increase risk of cardiovascular diseases. Some of the earlier investigations have revealed an increased incidence of myocardial infarction among male railway engine drivers that may be due to their continuous exposure to electro-magnetic field (*Piros, Karlehagen, Lappas, Wilhelmsen*, 2000).

Research has suggested that inflammatory markers, such as high-sensitivity C-reactive protein (hs-CRP), provide an alternative method for assessment of cardiovascular risk (*Ridker*, 1999). Furthermore, previous research reports suggest that yoga based lifestyle modifications help in regression of coronary lesions (*Bijlani, Vempati, Yadav, Ray, Gupta, Sharma, Mehta, Mahapatra*, 2005). Hence, the main objective of this study was to examine the effect of yoga training on high sensitivity CRP (hs-CRP) and lipid profile level in railway engine drivers.

Methods

Subjects: After approval of experimental procedures by the Institutional Ethics Committee, informed consent was obtained from thirty two male engine-drivers working in Indian railways at Mumbai region, who had no yoga practice background [age: 30-42 yr]. The participants were examined by a medical officer and those with known coronary disease were excluded from this study.

Experimental design: The subjects were randomly divided into two groups viz., yoga group (n = 16) and control group (n=16). Primarily, baseline concentrations of serum lipid profile and hs-CRP were taken from all the selected subjects of both the groups. The subjects of yoga group were then underwent a training of yoga practices under the overall supervision of yoga expert, whereas the comparable control group did not. The training was imparted to the yoga group daily one hour in the morning including Sundays and holidays for a total period of one month. However, both the groups participated in their regular lifestyle activities and duties assigned by the railways authorities. They were also advised to avoid non-vegetarian food. After completion of the experiment for one month, the testing of serum biochemistry was repeated.

Yoga Practices: The yoga group practiced a set of yoga techniques in the form of *asana* (postures) and *pranayama* (breathing techniques). The supine position asanas were *ardh-halasana (halplough) viparita karani (inverted pose), matsyasana (fish pose), naukasana (boat pose), setubandhasana (bridge pose), and sputa vakrasana (reclining adamant pose). The prone position asanas included were bhujangasana (cobra pose), ardhashalabhasana (half locust pose), shalabhasana (locust pose), and dhanurasana (bow pose). The sitting position asanas were vakrasana (twisted pose), gomukhasana (cow face pose), paschimatanasana (forward bending pose), ardha ushtrsana (half camel pose) while standing position asanas were tadasana (mountain pose), chakrasana (wheel pose), utkatasana (chair pose) vrikshasana (tree pose)*. The pranayama practices for this experiment were *anulom vilom and bhramari*. Each session of yoga practices was concluded with *om* chanting. The duration of each *asana* (posture) was ranged from 2 to 3 minutes depending upon the improvement in performance, whereas for practice of *pranayama* the duration was from 2-5 minutes.

Serum biochemistry: Serum samples were separated from the collected blood by using Vacutainer blood-collection tubes (Becton Dickinson) with the centrifugation at 1,000 *g* for 10 min after the blood was allowed to clot at room temperature for 30 min. Serum hs-CRP activity was measured by using Calbiotech (USA) enzyme immunoassay kit on *ELISA plate reader* (Bio-Rad 680, Bio-Rad PW 40, USA), where the sensitivity limit was 0.2 µg/ml. Further, biochemical assay kits as

prescribed for the analyzer Statfax-2000 (Awareness technology, USA) were used to measure Serum total Cholesterol, Triglycerides HDL, and LDL concentration.

Statistics: Since the primary outcome-variables were lipid profile and hs-CRP, the collected data were analyzed for evaluating mean and standard deviation; whereas within group comparisons were performed using paired t-tests, while between-group comparisons were performed using independent t-tests.

Results

The result of within group comparison revealed that the yoga group showed a significant decrease in *total cholesterol* (Tc), *triglyceride* (Tg) and hs-CRP ($t= 6.4$, $p<0.01$; $t= 10.42$, $p<0.01$; $t= 27.87$, $p<0.01$) (Table 1), whereas the control group revealed no change in Tc ($t= 0.28$ $p >0.05$) and in hs-CRP ($t= 1.58$, $p>0.05$) respectively, but significant increase in Tg ($t=19.66$, $p<0.01$) was evident. However, a significant decrease in LDL were observed in yoga ($t= 5.21$, $p<0.01$) and control groups ($t= 4.79$, $p<0.01$). Further, no change was evident in HDL in both yoga and control groups ($t=0.48$, $p>0.05$, $t=0.33$, $p>0.05$). This indicates yoga practice helps to reduce lipid profile to normal level and decreased CRP that reflects yoga reduced inflammation.
Further, the results between the group confirmed that the yoga group had significantly lower level of Tc, Tg and hs-CRP as compared to control group ($t=1.62$ $p< 0.05$, $t=1.83$, $p< 0.05$, $t=1.96$, $p< 0.05$). Trend of reduction in LDL was evident among the subjects of both the yoga and control groups; however, no statistically significant difference was evident between these groups ($t=1.04$, $p>0.05$) (Table 1). In case of HDL, trend of improvement was seen in both the yoga and control groups; however, no statistically difference between the groups was seen ($t=0.39$, $p>0.05$).

Table 1. Comparison of the baseline and final values (end of one month) of serum lipids and hs-CRP levels recorded at the end of the yoga program

Variable	Control Group			Yoga Group			Control Vs Yoga (t-value)
	Baseline (M±SD)	Final (M±SD)	t-value	Baseline (M±SD)	Final (M±SD)	t-value	
Total cholesterol (mg/dL)	175.06 (±18.23)	174.56 (±17.86)	0.28	191.81 (±20.38)	179.375 (±16.59)	6.4**	1.62*
Triglycerides (mg/dL)	118.56 (±12.45)	141.87 (±13.55)	19.66**	149.81 (±13.76)	134.18 (±13.34)	10.42**	1.83*
HDL (mg/dL)	51.75 (±6.23)	53.52 (±5.98)	0.48	51.36 (±5.77)	53.093 (±5.48)	0.33	0.39
LDL (mg/dL)	99.59 (±8.23)	94.81 (±8.56)	4.79**	99.95 (±8.67)	97.93 (±9.08)	5.21**	1.04
hsCRP (microgram / ml)	2.40 (±0.22)	2.37 (±0.18)	1.58	2.35 (±0.20)	1.87 (±0.19)	27.87**	1.96*
*p<0.05, **p<0.01							

Discussion

The result of this randomized control trial of one month yoga training could reduce total cholesterol, triglycerides, low density lipoprotein (LDL) and hs-CRP in railway engine drivers. However, there was no significant improvement in high density lipoprotein (HDL).

In the present study participants were railway engine drivers who are believed to be under stress. Previous study on railway engine drivers shows prevalence of high cardiovascular risk factors among these professionals (*Zdrenghea, Poanta, Gaita*, 2005). Further, the occupational stress can lead to progression of coronary atherosclerosis but it can be prevented by appropriate lifestyle modification. Elevated hsCRP has consistently provided incremental prognostic value for cardiovascular risk prediction beyond traditional risk factor assessment (*Ridker*, *Rifai, Rose* и сарадници, 2002). Weight loss and physical activity can lower hsCRP levels, and lifestyle changes are first-line therapy to lower CVD risk and regression of atherosclerosis (*Heilbronn, Noakes*, *Clifton*, 2001). In this perspective Indian traditional yoga practices were found beneficial for reducing stress and inflammation because one randomized trial suggested positive benefits for inflammation in heart patients (*Pullen, Nagamia, Mehta, Thompson, Benardot, Hammoud, Parrott, Sola, Khan*, 2008). There is ample of evidence suggesting positive effect of yoga lifestyle in cardiovascular disease (*Ornish, Scherwutz, Billings, Brown, Gould, Meritt, Sparler, Armstrong, Ports, Kirkeeide, Hogeboom, Brand*, 1998). In our study results shows reduction in hsCRP and lipoproteins and as the atherosclerotic process is characterized by inflammation one alternative explanation would be that regular practice of yoga, which offer protection against atherosclerosis, indirectly offers protection against vascular inflammation and hence, systemic low grade inflammation. This may be the mechanism by which yoga practices could have helped to reduce CRP levels. Other mechanisms linking exercise to lower inflammation levels may involve antioxidant effect of exercise. There is evidence that yoga practices can significantly elevate antioxidant defense (*Mahapure, Shete, Bera*, 2008).

Finally, the reduction in the lipoproteins and CRP, even though, is less in magnitude but achieved by a very simple and inexpensive intervention. This is of importance, because railway engine drivers are at higher risk of developing cardiovascular disease. Although lipoproteins and hsCRP are the tools for estimating coronary artery disease in healthy adults, this study has some limitations. It does not include other well established risk factors, such as BMI, alcohol intake, levels of physical activity or the presence of or absence of parental history of coronary artery disease**.** Though this study was conducted on a small sample, the results appeared are promising. However, future study on larger population is required to confirm the beneficial effects of yoga. Since, our study was limited to measures of hsCRP and lipoproteins other prospective studies estimating specific cytokines related to inflammation will be required to elucidate role of yoga in the prevention and regression of CAD.

Conclusion

The present study has demonstrated that yoga practices are associated with regression of inflammatory process by reducing CRP levels in a representative sample of apparently healthy middle aged railway engine drivers. Since, elevated levels of CRP and other markers have been shown to important predictors of coronary atherosclerosis, current study implies that yoga practices seems to be of lower risk in controlling coronary atherosclerosis by reducing inflammation. Further studies that examine yoga as a prospective predictor of inflammation in general population sample are needed to definitively establish whether yoga truly prevents or reduces inflammation by assessing various other inflammatory markers.

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