



Research Article

ISSN 2320-4818

JSIR 2020; 9(2): 63-68

© 2020, All rights reserved

Received: 03-06-2020

Accepted: 30-06-2020

Avneesh Prasad

DNB Cardiology, Senior Resident, National Heart Institute, New Delhi, India

Saurabh Bhardwaj

DNB Cardiology, Senior Resident, National Heart Institute, New Delhi

Shridhar Dwivedi

Dwivedi- Senior Consultant Cardiology, National Heart Institute, New Delhi

YK Arora

Senior Consultant Cardiologist, National Heart Institute, New Delhi

V Sharma

Senior Consultant Cardiology, National Heart Institute, New Delhi

Correspondence:

Dr. Avneesh Prasad

DNB Cardiology, Senior Resident, National Heart Institute, New Delhi, India

Email: avneeshprasad@gmail.com

Effect of Yoga in Post-Myocardial Infarction Cases

Avneesh Prasad*, Saurabh Bhardwaj, Shridhar Dwivedi, YK Arora, V Sharma

Abstract

Introduction: The prevalence of coronary artery disease (CAD) has progressively increased in India and is the major cause of morbidity and mortality burden in the world. Several strategies are available to reduce morbidity and mortality, including the interventional approach (eg, early revascularization with PCI and stenting) and the pharmacologic approach (eg, thrombolytic and anticoagulant therapies) and yoga^{1,2}. The various psychological responses to experiencing myocardial infarction are anxiety reactions, depression, agoraphobia, exhaustion, hostility, sadness, anger, disgust and social withdrawal.³ Yoga has reported to decrease these incidences. **Methodology:** The study included 200 patients diagnosed as MI who were divided into two groups 100 cases of control group subjected to conventional treatment and lifestyle counseling while 100 cases in test group were treated with yoga in addition to conventional treatment and lifestyle modification. The primary outcome included change in risk factors from baseline to end of study. Secondary outcome included change in Depression score and MACE at the end of the study. Result -After 24 weeks of intervention, the difference among yoga and control group was found to be significant for following parameters- weight, BMI, waist circumference, post prandial blood sugar, HbA1c, HDL cholesterol, triglyceride, total cholesterol and depression score. A significant difference was not seen for mean CIMT. **Conclusion:** Yoga may be a cost-effective technique to target multiple risk factors of myocardial infarction. It can be recommended along with conventional treatment for prevention and improvement of outcome in MI patients

Keywords: Yoga, MI, transcendental meditation, risk factors, CIMT, MACE, Depression score.

INTRODUCTION

Coronary artery disease (CAD) is the major cause of morbidity and mortality burden in the world. Global burden of disease study estimates that by the year 2020, the burden of atheroembolic cardiovascular disease in India would surpass that in any other region in the world.¹ Myocardial infarction (MI) is the leading cause of death, accounting for roughly 7 million deaths and 129 million DALYs annually [2].

Risk factors for MI include older age, male sex, previous atheromatous cardiovascular disease, diabetes, hypercholesterolemia, hypertension and some related to lifestyle include diet, smoking, physical inactivity and psychosocial stress [3]. Several strategies are available to reduce morbidity and mortality, including the interventional approach (eg, early revascularization with PCI and stenting) and the pharmacologic approach (eg, thrombolytic and anticoagulant therapies) [4].

Yoga appears to be especially beneficial in CVD (cardiovascular disease) prevention [6]. The various psychological responses to experiencing myocardial infarction are anxiety reactions, depression, agoraphobia, exhaustion, hostility, sadness, anger, disgust and social withdrawal. Major depression is common among patients recovering from MI [6]. Yoga has shown to decrease the number of anginal episodes per week, improved exercise capacity and decrease in body weight. It has also been shown to reduce serum cholesterol levels (total cholesterol, LDL cholesterol, triglycerides). Yoga intervention alone or with behavior therapy may be able to enhance quitting smoking rates.⁷ Yoga is reported to reduce stress and anxiety, improve autonomic function by triggering neurohumoral mechanism [8]. Yoga helped in the reduction of sympathetic activity with reduction in heart rate, oxygen consumption and breath volume thus facilitating protection against CAD [9].

Most of the studies performed have been single centre with relatively small sample size and non-uniform methodologies have been used. However, as yoga is cost effective, it can be recommended along with conventional treatment for the prevention and improvement of outcome in MI cases. In this study, we aim to investigate the effect of Yoga in post-myocardial infarction cases with particular reference to risk factors, depression and MACE.

MATERIALS AND METHODS

Study was conducted in National Heart Institute, New Delhi on patients diagnosed as myocardial infarction. The inclusion criteria consisted of patients of myocardial infarction more than 18 years of age. For patients presenting as myocardial infarction, typical rise and fall of biochemical markers of myocardial necrosis with any one of the following [10] - Ischemic symptoms, development of pathologic Q waves, ECG changes indicative of ischemia (ST segment elevation or depression), and cases of ischemic symptoms without ST segment elevation were categorized as NSTEMI if cardiac biomarkers are positive.

The exclusion criteria consisted of hemodynamically unstable patients, advanced heart failure, pregnancy or postpartum ≤ 3 months, practiced yoga >1 time per month in the previous 6 months, known arrhythmias or on cardiac pacemaker, autonomic neuropathy (eg, Shy-Drager syndrome, orthostatic hypotension), severe musculoskeletal problems such as spinal stenosis that may limit participation in yoga and practice of other mind-body therapies.

The sample size of the patient was taken to be 200 (100 cases consisting of test group who were subjected to conventional treatment, lifestyle counselling and yoga was added as an adjuvant therapy & 100 cases consisting of control group who were subjected to conventional treatment and lifestyle counseling). The cases were randomized into two groups- test group and control group. Both groups were given standard treatment and counseling regarding tobacco cessation, diet and appropriate exercises with the help of power point presentation.

Education about yoga was given on 3rd post MI day /ICU stay and its effect on heart, lung and overall health was taught by the help of power point presentation. On 4th post MI /post CCU day patient were encouraged to start yoga. The study used a therapeutic form of yoga (Pranayam¹¹, Shavasana [12], Transcendental meditation /TM¹³) which was calm, meditative yoga based on deep breathing and was designed so that participants (if needed) may sit on a chair and exercise certain movements. During each yoga session, 10 min of Pranayam, 15 min of asana(Shavasana), and 15 min of transcendental meditation(TM) was performed twice daily under supervision of a resident / clinician / trained yoga expert. Weekly follow-up of all patients in demonstration hall (physiotherapy room) for initial 4 weeks was done then follow-up after 24 weeks for the assessment of clinical parameters, biochemical parameters, echocardiography, carotid doppler, depression scoring and MACE was done.

The study was conducted for 18 months from 1/7/2017 to 31/12/2018. The test group and control group were followed after 24 weeks of intervention period. The primary outcome included change in risk factors from baseline to end of study. Secondary outcome included change in Depression score and MACE at the end of the study.

The variables were expressed as means \pm SD, absolute numbers and percentages. A p value <0.05 was considered statistically significant. Data obtained was analyzed statistically by SPSS software.

RESULTS AND OBSERVATIONS

A total of 200 patients of MI were randomized into yoga group (N=100) aged more than 18 years (Mean age 59.83 ± 11.41 years). Also randomized were patients who were subjected to conventional treatment and lifestyle modifications (N=100) of similar age (Mean age 60 ± 11.53 years) and location. Among the yoga group, 68 were males and 32 were females. Among the control group there were 68 males and 32 females.

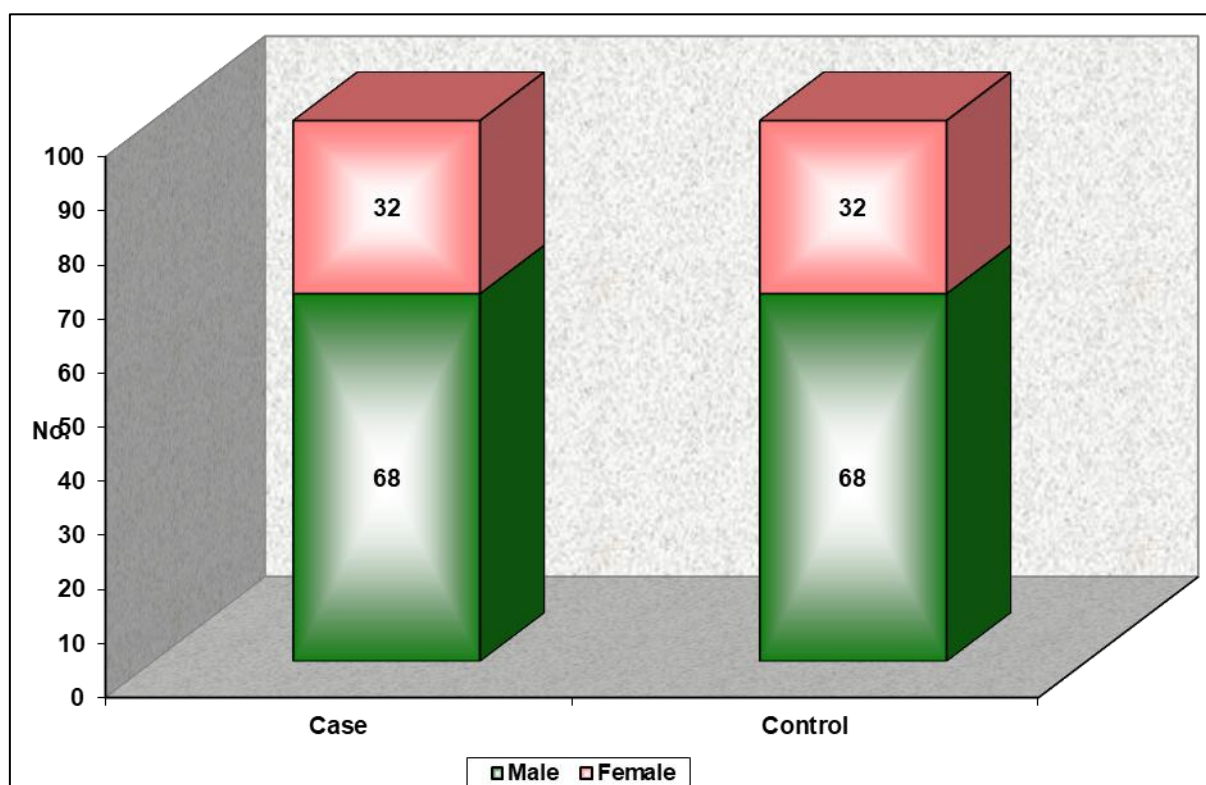


Figure 1: Distribution of subjects according to sex

Among the yoga group, 44 patients suffered anterior wall MI, 31 suffered inferior wall MI, 19 suffered NSTEMI, 2 inferoposterior MI and 4 inferolateral MI. Among the control group, 36 patients suffered anterior wall MI, 33 suffered inferior wall MI, 20 suffered NSTEMI, 6

inferolateral MI and 3 inferoposterior MI. There was no statistical significant difference on type of MI among both the groups.

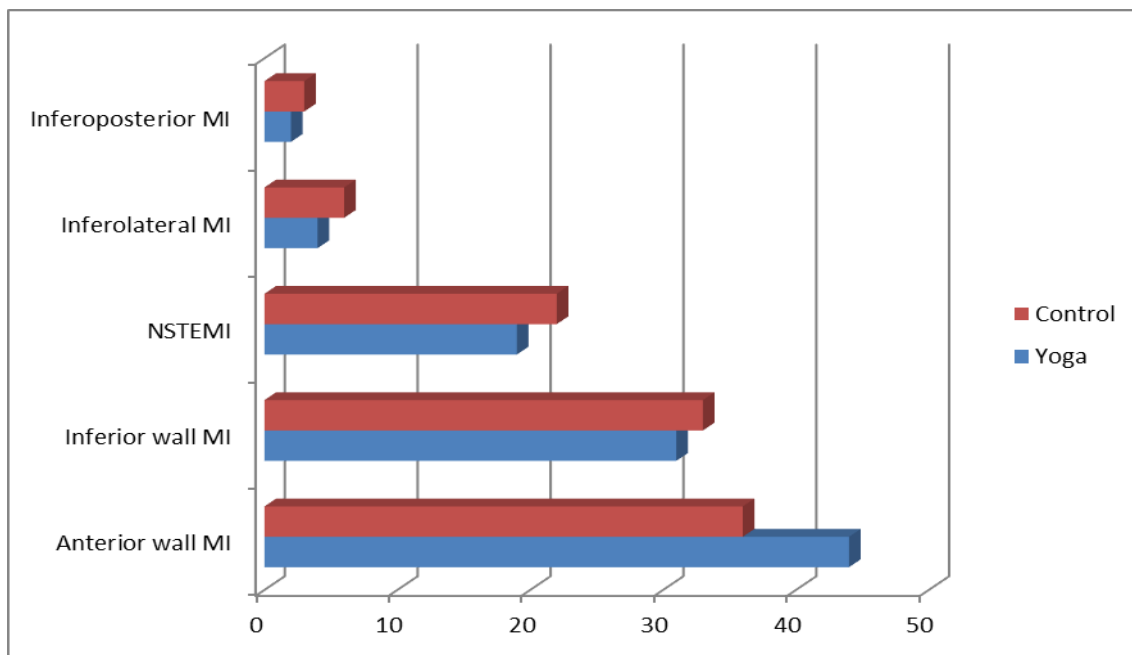


Figure 2: Distribution of type of MI among both groups

Clinical and physiological characteristics of the patients at the start of intervention: The baseline parameters are shown in the following table.

Table 1: Clinical and physiological characteristics at baseline.

Parameter	Group	N	Mean	SD	Median	Minimum	Maximum	'p' Value*
Ht	Yoga	100	1.63	0.08	1.64	1.49	1.85	1.000
	Control	100	1.63	0.07	1.64	1.52	1.85	
Weight	Yoga	100	75.74	9.83	76	55	96	0.107
	Control	100	78.12	10.94	79	55	96	
BMI	Yoga	100	28.36	3.50	28.1	20.6	39.6	0.067
	Control	100	29.46	4.83	29.7	20.5	40	
WC	Yoga	100	88.03	8.67	86.7	75.7	110	0.604
	Control	100	87.42	7.93	85.45	76.1	106	
HR	Yoga	100	79.40	12.70	79	54	110	0.392
	Control	100	80.94	12.71	81	54	110	
SBP	Yoga	100	132.48	16.31	134	90	164	0.018
	Control	100	126.96	16.33	128	94	160	
DBP	Yoga	100	76.28	9.59	76	56	96	0.701
	Control	100	76.78	8.75	76	58	94	
FBS	Yoga	100	127.57	43.77	117.5	72	254	0.091
	Control	100	118.33	32.19	120	74	183	
PP	Yoga	100	181.98	59.83	175	108	356	0.817
	Control	100	180.04	58.74	188	105	306	
HBA1C	Yoga	100	6.87	1.62	6.1	5.4	11.8	0.413
	Control	100	6.70	1.29	6.15	5.4	10.1	
HDL	Yoga	100	48.78	12.06	49	25	72	0.002
	Control	100	43.89	9.60	42	28	64	
LDL	Yoga	100	105.31	33.37	104	64	209	0.001
	Control	100	119.79	28.24	124	72	184	
TG	Yoga	100	125.44	46.31	131.5	60	212	0.217
	Control	100	133.03	40.15	134	36	232	
T.CH	Yoga	100	179.18	32.48	170.7	129.8	276	0.010

	Control	100	190.29	28.03	193.4	137.6	259.6	
CIMT Left	Yoga	100	0.804	0.175	0.839	0.445	1.170	0.245
	Control	100	0.833	0.177	0.860	0.442	1.360	
CIMT Right	Yoga	100	0.811	0.186	0.842	0.437	1.340	0.420
	Control	100	0.833	0.199	0.868	0.428	1.430	
CIMT Mean	Yoga	100	0.808	0.179	0.846	0.442	1.240	0.333
	Control	100	0.833	0.185	0.860	0.435	1.395	
Depression Score	Yoga	100	12.04	5.63	12	3	32	0.666
	Control	100	11.71	5.15	11	3	24	

Difference between the yoga group and control group after a period of 24 weeks of intervention

Table 2: Comparison of mean changes in parameters after intervention between yoga and control group

Parameter	Group	N	Mean	SD	Median	Minimum	Maximum	'p' Value*
Ht	Yoga	100	0.00	0.00	0	0	0	NA
	Control	100	0.00	0.00	0	0	0	
Weight	Yoga	100	2.60	1.22	3	0	5	<0.001
	Control	100	1.92	1.11	2	-2	4	
BMI	Yoga	100	1.04	0.86	1.03	-0.7	8.1	0.001
	Control	100	0.72	0.43	0.70	-0.8	1.7	
WC	Yoga	100	1.74	1.72	1.9	-1.8	4.9	0.005
	Control	100	1.04	1.76	1.5	-3.6	4.6	
HR	Yoga	100	3.28	8.75	4	-20	26	0.891
	Control	100	3.12	7.74	4	-16	26	
SBP	Yoga	100	2.78	6.52	4	-14	16	0.855
	Control	100	2.62	5.80	4	-10	16	
DBP	Yoga	100	1.60	3.58	2	-8	8	0.369
	Control	100	1.14	3.64	2	-8	8	
FBS	Yoga	100	10.17	22.54	8	-77	66	0.094
	Control	100	5.89	11.81	6.5	-28	30	
PP	Yoga	100	0.20	0.41	0	-0.4	1.7	0.002
	Control	100	0.06	0.18	0	-0.3	0.5	
HBA1C	Yoga	100	-5.54	2.16	-5	-12	0	<0.001
	Control	100	-3.06	2.92	-3	-10	8	
HDL	Yoga	100	16.78	9.43	14	4	58	0.001
	Control	100	12.19	10.17	12	-23	34	
LDL	Yoga	100	15.81	28.50	8.5	-43	100	0.240
	Control	100	11.73	19.64	10	-46	68	
TG	Yoga	100	15.52	10.08	14	-2	46	<0.001
	Control	100	9.68	11.48	10.5	-43	47	
T.CH	Yoga	100	14.14	10.27	10.8	-9.8	56.2	0.029
	Control	100	11.07	9.51	12	-21	32.4	
CIMT Left	Yoga	100	0.004	0.019	0.005	-0.010	0.101	0.687
	Control	100	0.003	0.012	0.003	-0.060	0.060	
CIMT Right	Yoga	100	0.012	0.020	0.006	-0.012	0.110	0.054
	Control	100	0.001	0.053	0.004	-0.499	0.100	
CIMT Mean	Yoga	100	0.003	0.018	0.006	-0.008	0.100	0.764
	Control	100	0.002	0.028	0.004	-0.248	0.070	
Depression Score	Yoga	100	2.38	1.55	2	0	8	<0.001
	Control	100	1.35	1.08	1	-2	4	

After 24 weeks of intervention, the difference among yoga and control group was found to be significant for following parameters- weight (Mean-2.60±1.22 kg vs 1.92±1.11 kg, p<0.001), BMI (Mean-1.04±0.86 kg/m² vs 0.72±0.43kg/m², p=0.001), waist circumference (Mean-1.74±1.72cm vs 1.04±1.76cm,p=0.005), post prandial blood sugar (Mean-0.20±0.41mg/dl vs 0.06±0.18mg/dl, p=0.002), HBA1c (Mean- 5.54±2.16% vs -3.06±2.92%,p<0.001) , HDL cholesterol (Mean-16.78±9.43mg/dl vs 12.19±10.17mg/dl ,p=0.001), triglyceride (Mean-15.52±10.08mg/dl vs 9.68±11.48mg/dl,p<0.001) , total cholesterol (Mean-14.14±10.27mg/dl vs 11.07±9.51mg/dl,p=0.029) and depression score (Mean- 2.38±1.55 vs 1.35±1.08, p<0.001). A significant difference was not seen for mean CIMT (0.003±0.018mm vs 0.002±0.028mm, p=0.764)

Between the yoga and control group after 24 weeks of intervention, smoking cessation was found to be statistically significant (p=0.001).Yoga group witnessed 2 MACE events (1 MI/revascularization and 1 stroke) and control group witnessed 6 MACE events (5 MI/revascularization and 1 stroke). Occurrence of MACE was not found to be statistically significant (p=0.253).

DISCUSSION

The mean age in yoga group was 59.83±11.41years and in the control group was 60±11.53 years which is consistent with the findings of previous studies that old age is a risk factor for MI due to associated comorbidities, functional deterioration , cumulative effect of risk factors ,and side effects of medications. Our study included 68 males and 32 females in both groups, suggesting higher prevalence of MI among males than in females, mainly due to risk factors which are more prevalent among males. Male dominance of CAD has already been reported in earlier studies [14, 15].

Reduction in weight was found to be significant in yoga group as compared to the control group (2.60±1.22 kg vs 1.92±1.11 kg, p<0.001). Previous study by Cramer H.et al. [16] found reduction in body weight after 12 weeks of yoga program which was significant in comparison to control group (p<0.05). Patil Smita V,et al [17] also found significant reduction in weight after pranayama, supporting our results. Thus, yoga may be incorporated as weight reduction lifestyle measure for the prevention of MI.

In our study, we found significant reduction in BMI (1.04±0.86 kg/m² vs 0.72±0.43kg/m², p=0.001), as well as waist circumference (1.74±1.72cm vs 1.04±1.76cm,p=0.005). Manchanda SC.et al. [18] found significant reduction in BMI and waist circumference in yoga group compared to control group. Our findings are also consistent with the findings of Kekan D and Kashalikar S [19] who found that 8 weeks of pranayama significantly reduces the waist circumference. Chauhan A, et al. [20] also showed that savasana, pranayama and meditation can lead to decrease in BMI.

Our study found a decrease in heart rate (p=0.891) as well as systolic (p=0.855) and diastolic blood pressure (p=0.369) between the yoga and control group but it was not statistically significant. This finding is not in accord with previous studies. Study by Krishna BH, et al. [21] found out significant decrease in heart rate and blood pressure after 12 weeks of yoga intervention. Similarly, Sinha SS [22] also found a significant decrease in heart rate, systolic and diastolic blood pressure after 6 months of yoga. Although, our study did not find a significant reduction in heart rate, systolic and diastolic blood pressure. It may be due to the optimal doses of beta blockers or ACE inhibitors which most of the patient are taking after MI. Further studies are needed to elucidate the effect of yoga on heart rate and blood pressure.

Our study found a significant decrease in post prandial blood sugar (0.20±0.41mg/dl vs 0.06±0.18mg/dl, p=0.002) as well as for HBA1c (-5.54±2.16% vs -3.06±2.92%,p<0.001) between the yoga group and control group. Our study did not find a significant decrease in fasting blood sugar (p=0.094). Our finding is in accord with finding of Jali MV.et al. [23] who found a significant decrease in post prandial blood sugar (p<0.001) and HBA1c (p<0.001) as well as for fasting blood sugar after

yoga intervention of 12 months. Sinha SS. et al. [24] also found significant decrease in blood sugar levels and glycosylated hemoglobin .Thus, yoga is beneficial in control of blood sugar levels and may be beneficial in reduction of the risk of MI.

In our study, a significant increase in HDL cholesterol levels were noted (16.78±9.43mg/dl vs 12.19±10.17mg/dl, p=0.001) between the yoga group and control group. A significant decrease in triglyceride (15.52±10.08mg/dl vs 9.68±11.48mg/dl,p<0.001) and total cholesterol levels (14.14±10.27mg/dl vs 11.07±9.51mg/dl,p=0.029) were also seen. A decrease in LDL was also seen but it was not found to be statistically significant (p=0.240), showing a favourable effect of yoga on lipid profile. Our findings are consistent with studies by Prasad and Bhardwaj²⁵ and Negi A [26]. Thus, yoga may be helpful in risk reduction of MI by having a favourable effect on lipid profile.

Our study found that there was a regression of mean CIMT after yoga intervention than in controls (0.003±0.018mm vs 0.002±0.028mm, p=0.764) but it was not statistically significant . This finding is in accord with the study done by S.Manchanda et al. [18] who showed a significant regression of CIMT (p<0.001) after 12 months of yoga. Our findings are also consistent with the studies by Sahmin Lee,et al. [27] and Byrkejeland R.et al. [28] who showed a positive response of yoga on regression of CIMT. CIMT is a marker of early atherosclerosis and its regression by yogic interventions may lead to risk reduction of MI.

In our study, a significant reduction in Beck's depression inventory score was also seen in yoga group as compared to controls (2.38±1.55 vs 1.35±1.08, p<0.001). Findings by Shapiro D.et al. [29], Yunesian M et al. [30] and Woodyard C [31] state that yogic interventions enhance muscular strength, body flexibility, improve cardiovascular function, reduce stress and anxiety, improve sleep patterns and enhance overall well being and quality of life.

Importantly, our study found a statistically significant association of smoking cessation in yoga group as compared to control group (p=0.001). These findings are consistent with the study done by Tang YY, et al [32] who showed that meditation can significantly reduce craving for smoking. Study by Dwivedi S [33] also found that behavioural alterations and lifestyle measures can lead to smoking cessation. Our findings however do not comply with the findings of Haaga DA, et al. [34] who stated that there was no effect of transcendental meditation on smoking cessation and illicit drug use. Further studies are needed to find out effect of yoga on smoking cessation.

Finally, in our study yoga group witnessed 2 MACE events (1 MI/revascularization and 1 stroke) whereas control group witnessed 6 MACE events (5 MI/revascularization and 1 stroke). Occurrence of MACE was found to be statistically insignificant between the two groups (p=0.253). In this context, notably, Geetha Subramanian, et al. [35] and Schneider RH, et al. [36] found significant reduction in MACE events in yoga group as compared to control group. This was ascribed to better control of hypertension and diabetes mellitus II, smoking and alcohol cessation. This issue needs longer term studies for determining the effect of yoga on MACE events.

CONCLUSION

On the basis of our study, we conclude that the addition of yoga to conventional therapy along with lifestyle interventions in post MI cases resulted in significant reduction in primary outcomes of study like weight, BMI, waist circumference, blood sugars, glycosylated hemoglobin, lipid profile (triglycerides, Total cholesterol) and smoking cessation as well as significant increase in HDL cholesterol. Yogic intervention also resulted in decrease in secondary outcomes like Beck's depression Inventory score but did not find significant reduction in occurrence of MACE.

Thus, yoga may be a cost-effective technique to target multiple risk factors of myocardial infarction. It can be recommended along with conventional treatment for prevention and improvement of outcome in MI patients. Larger trial is required with long term follow up to see the

future beneficial effect of yogic intervention and lifestyle modification in altering the risk factors in post MI cases so that it may be incorporated with medical treatment in all cases of myocardial infarction during recovery and cardiac rehabilitation.

REFERENCES

1. Akram MV, Zaidi F, Bansal S, Kishore K. A study of risk factors in young patients of myocardial infarction. *Int J Res Med Sci* 2015;3:2677-81.
2. Murray CJ, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2012;380:2197-223.
3. Anand SS, Islam S, Rosengren A, et al. Risk factors for myocardial infarction in women and men: insights from the INTERHEART study. *European Heart Journal* 2008; 29: 932-40.
4. Yan AT, Yan RT, Tan M, et al. In-hospital revascularization and one-year outcome of acute coronary syndrome patients stratified by the GRACE risk score. *Am J Cardiol*. 2005;96(7):913-6.
5. Raub J. Psychophysiologic effects of Hatha Yoga on musculoskeletal and cardiopulmonary function: A literature review. *J Altern Complement Med*. 2002;8:797-812.
6. Mierzyńska A, Kowalska M, Stepnowska M, et al. Psychological support for patients following myocardial infarction. *Cardiol J* 2010; 17, 3: 319-24.
7. Manchanda S, Narang R, Reddy KS, et al. Retardation of coronary atherosclerosis after yoga lifestyle interventions. *J Assos Physicians India*. 2000;48:687-94.
8. Hammer A. Ein Fall von thrombotischem Verschlusse einer der Kranzarterien des Herzens. *Wien Med Wschr* 1878;28:97-102.
9. World Health Organization. Working Group on the Establishment of Ischemic Heart Disease Registers. Report of the Fifth Working Group, Copenhagen. In: Report No. Eur 8201 (5). Geneva: World Health Organization; 1971.
10. Reed GW, Rossi JE, Cannon CP. Acute myocardial infarction. *Lancet* 2017;389:197-210.
11. Sengupta P. Health impacts of yoga and pranayama: A state-of-the-art review. *Int J Prev Med* 2012;3(7):444-58.
12. Shinde V, Kini R, Naik R, et al. A Study on the Effect of Relaxation Techniques and Shavasana on Stress and Pulse Rates of Medical Students. *Journal of exercise science and physiotherapy*. 2015;11: 123-8.
13. Elder C, Nidich S, Moriarty F, Nidich R. Effect of transcendental meditation on employee stress, depression, and burnout: a randomized controlled study. *Perm J*. 2014;18(1):19-23.
14. Chauhan S, Aeri BT. Prevalence of cardiovascular disease in India and its economic impact. *International Journal of Scientific and Research Publications*. 2013; 3(10):1-5.
15. Carro A, Kaski JC. Myocardial infarction in the elderly. *Aging Dis*. 2011; 2(2):116-37.
16. Cramer H, Thoms MS, Anheyer D, Lauche R, Dobos G. Yoga in Women With Abdominal Obesity-a Randomized Controlled Trial. *Dtsch Arztebl Int*. 2016;113(39):645-52.
17. Patil SV, Gaikwad PB, Jadhav ST et al. Effect of pranayama on body mass index in young medical students. *Int J Res Rev*. 2016; 3(2):24-7.
18. Manchanda SC, Mehrotra UC, Makhija A, Mohanty A, Dhawan S, et al. Reversal of Early Atherosclerosis in Metabolic Syndrome by Yoga – A Randomized Controlled Trial. *J Yoga Phys Ther* 2013; 3: 132.
19. Kekani D, Kashalikar S. Effect of Kapalbhathi Pranayama on waist and Hip Circumference. *Journal of Evolution of Medical and Dental Sciences* 2013; 2(11):1695-9.
20. Chauhan A, Semwal DK, Mishra SP, Semwal RB. Yoga Practice Improves the Body Mass Index and Blood Pressure: A Randomized Controlled Trial. *Int J Yoga*. 2017;10(2):103+6.
21. Krishna BH, Pal P, G K P, et al. Effect of yoga therapy on heart rate, blood pressure and cardiac autonomic function in heart failure. *J Clin Diagn Res*. 2014;8(1):14-6.
22. Sinha SS, Jain AK, Tyagi S et al. Effect of Meditation on Heart Rate, Blood Pressure and Exercise Performance in Coronary Artery Disease Patients. *Indian J Physiol Pharmacol* 2018;62(2):209-21.
23. Jali MV, Deginal RB, Ghagane SC, et al. The influence of yoga therapy in adults with type 2 diabetes mellitus: A single-center study. *Yoga Mimamsa*. 2017; 49(1):9-12.
24. Sinha SS, Jain AK, Tyagi S, Gupta SK, Mahajan AS. Effect of 6 Months of Meditation on Blood Sugar, Glycosylated Hemoglobin, and Insulin Levels in Patients of Coronary Artery Disease. *Int J Yoga*. 2018;11(2):122-8.
25. Prasad G. and Bhardwaj I. Effect of comprehensive yogic practices on lipid profile of urban population. *International Journal of Science and Consciousness* 2017; 3(2): 24-8.
26. Negi A, Joshi LN. Comparison of lipid profile between middle aged yoga practitioners and non practitioners. *European Journal of Physical Education and Sport Science*. 2019; 5 (7) :ISSN 2501 2428. Available at: <<https://oapub.org/edu/index.php/ejep/article/view/2374/5012>>. (Accessed:4th May,2019)
27. Sahmin Lee, Goo-Yeong Cho, Goo-Yeong Cho, Hyun-Sook Kim, Yeonyee E. Yoon, Seung-Pyo Lee et al. Common carotid intima-media thickness as a risk factor for outcomes in asian patients with acute ST-elevation myocardial infarction. *Canadian Journal Of Cardiology* 2014; 30(12): 1620-6.
28. Byrkjeland R, Stensaeth KH, Anderssen S, Njerve IU, et al. Effects of exercise training on carotid intima-media thickness in patients with type 2 diabetes and coronary artery disease. Influence of carotid plaques. *Cardiovasc Diabetol*. 2016; 15(13).
29. Shapiro D, Cook IA, Davydov DM, Ottaviani C, Leuchter AF, Abrams M. Yoga as a complementary treatment of depression: effects of traits and moods on treatment outcome. *Evid Based Complement Alternat Med*. 2007;4(4):493-502.
30. Yunesian M, Aslani A, Vash JH, Yazdi AB. Effects of Transcendental Meditation on mental health: a before-after study. *Clin Pract Epidemiol Ment Health*. 2008;4:25.
31. Woodyard C. Exploring the therapeutic effects of yoga and its ability to increase quality of life. *Int J Yoga*. 2011;4(2):49-54.
32. Tang YY, Tang R, Posner MI. Brief meditation training induces smoking reduction. *Proc Natl Acad Sci USA*. 2013;110:13971-5.
33. Dwivedi S, Tyagi P. Yoga as a health promotion lifestyle tool. *Indian Journal of Medical Specialities*. 2016 ;7(1):29-34.
34. Haaga DA, Grosswald S, Gaylord-King C, Rainforth M, Tanner M, Travis F, et al. Effects of the transcendental meditation program on substance use among university students. *Cardiol Res Pract*. 2011;2011:537101.
35. Subramanian G, Chidambaram S, Venkatesa S. Impact of Sahaja yoga meditation as an adjunct to medical treatment on post myocardial infarction patients in a tertiary cardiac center: 2 years experience. *Indian heart journal*. 2014;66: S1-S143.
36. Schneider RH, Grim CE, Rainforth MV, et al. Stress reduction in the secondary prevention of cardiovascular disease: randomized, controlled trial of transcendental meditation and health education in Blacks. *Circ Cardiovasc Qual Outcomes*. 2012;5(6):750-8