

Effect of Yoga on Cardiac Autonomic Function Tests in Obese and Non-Obese Patients with Myocardial Infarction: A Comparative and Interventional Study



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Abstract

Background: Obesity and myocardial infarction (MI) both weaken the nervous control of the heart. Low heart rate variability (HRV) after MI is linked with higher mortality. This study compared HRV and lipid profile in obese and non-obese MI patients, and tested the effect of 12 weeks of yoga in obese MI patients.

Methods: This hospital-based study at Index Medical College, Malwanchal University, Indore included 100 obese MI patients (BMI ≥ 25 kg/m²), 100 non-obese MI patients (BMI 18.5–22.9 kg/m²) and 100 healthy controls, aged 35–65 years. Fifty obese MI patients did supervised yoga for 12 weeks along with standard care. HRV (SDNN, RMSSD, LF/HF ratio), lipid profile, HbA1c, Troponin T, CK-MB and QTc were measured. Welch's t-test and the paired t-test were used.

Results: Obese MI patients had lower SDNN (69.9 ± 6.1 vs 83.6 ± 17.9 ms) and RMSSD (17.5 ± 4.9 vs 51.0 ± 11.1 ms) than non-obese MI patients ($p < 0.001$). They also had higher LDL, total cholesterol, triglycerides, CK-MB and QTc, and lower HDL (all $p < 0.001$). After yoga, LDL fell by 8.7%, total cholesterol by 22.6% and triglycerides by 30.5%, and HDL rose by 19.5% (all $p < 0.001$). HRV and BMI did not change significantly.

Conclusion: Obese MI patients have poorer HRV and a worse lipid profile than non-obese MI patients. Twelve weeks of yoga improved the lipid profile but not HRV. Yoga is a useful add-on to standard care after MI.

Keywords: Yoga; Heart rate variability; Cardiac autonomic function; Obesity; Myocardial infarction; Lipid profile.

Introduction

Cardiovascular disease is the leading cause of death worldwide, and MI is its most important form [1]. Indians develop heart disease about ten years earlier than Western populations [2]. Obesity is a major risk factor. In Asian Indians, a BMI of 25 kg/m² or more is taken as obesity [3].

Obesity and MI both disturb the autonomic control of the heart. Obese people have higher sympathetic activity and lower vagal tone [4,5]. HRV is a simple, non-invasive test of this balance [6]. Low HRV after MI predicts a higher risk of death [7,8].

Yoga includes postures, breathing exercises and relaxation. It may lower sympathetic activity and raise vagal tone [9]. Studies on yoga and HRV show mixed results [10,11]. Yoga is safe after MI [12] and can improve the lipid profile in heart patients [13,14]. Indian studies comparing obese and non-obese MI patients are few. This study aimed to (i) compare HRV, lipid profile and cardiac markers between obese and non-obese MI patients, and (ii) study the effect of a 12-week yoga programme in obese MI patients.

Materials and Methods

Study design. This was a hospital-based comparative and interventional study at Index Medical College, Malwanchal University, Indore, India. The protocol was approved by the Institutional Ethics Committee, and written informed consent was taken from all participants.

Participants. Patients aged 35–65 years of either sex with confirmed MI [15] were included. BMI was classified by Asian-Indian cut-offs [3]. There were four groups:

- Group I: 100 obese MI patients (BMI ≥ 25 kg/m²).
- Group II: 100 non-obese MI patients (BMI 18.5–22.9 kg/m²).
- Group III: 100 healthy controls of similar age and sex.
- Group IV: 50 obese MI patients from Group I who did yoga for 12 weeks.

Patients with prior regular yoga practice, unstable condition, serious arrhythmia, severe other illness or pregnancy were excluded. The minimum sample size was 36 per group (SDNN difference 10 ms, SD 15 ms, 80% power, $\alpha = 0.05$).

Yoga. Group IV did supervised yoga sessions of 45–60 minutes for 12 weeks along with standard care. Each session had loosening exercises, gentle asanas (Tadasana, Ardha Katichakrasana, Sukhasana, Vajrasana, modified Pawanmuktasana, Makarasana), pranayama (Anulom-Vilom, Bhramari, gentle Ujjayi) and Shavasana with meditation. Strenuous postures and breath-holding were avoided.

Measurements. A 5-minute resting ECG was recorded in the supine position. SDNN, RMSSD and the LF/HF ratio were calculated as per standard guidelines [6]. Fasting total cholesterol, triglycerides and HDL were measured, and LDL was calculated by the Friedewald formula [16]. HbA1c, Troponin T and CK-MB were also measured. QTc was calculated by Bazett's formula [17]. BMI, HRV and lipids were measured again in Group IV after 12 weeks.

Table 1. Comparison of obese MI, non-obese MI and healthy control groups (mean $\pm$ SD)

Parameter	Obese MI (n = 100)	Non-obese MI (n = 100)	Healthy controls (n = 100)	p (obese vs non-obese)
Age (years)	49.7 $\pm$ 9.1	46.0 $\pm$ 7.0†	46.5 $\pm$ 6.9	0.001
BMI (kg/m ²)	27.5 $\pm$ 1.8	21.1 $\pm$ 1.8	21.6 $\pm$ 2.2	< 0.001
SDNN (ms)	69.9 $\pm$ 6.1	83.6 $\pm$ 17.9	74.1 $\pm$ 16.0	< 0.001
RMSSD (ms)	17.5 $\pm$ 4.9	51.0 $\pm$ 11.1	37.6 $\pm$ 7.6	< 0.001
LF/HF ratio	2.74 $\pm$ 0.47	3.45 $\pm$ 0.55	1.51 $\pm$ 0.30	< 0.001
LDL (mg/dL)	162.9 $\pm$ 14.2	95.0 $\pm$ 19.7	83.9 $\pm$ 22.7	< 0.001
HDL (mg/dL)	34.5 $\pm$ 3.3	50.2 $\pm$ 13.3	67.1 $\pm$ 14.3	< 0.001
Total cholesterol (mg/dL)	258.2 $\pm$ 11.8	173.9 $\pm$ 14.9	174.1 $\pm$ 16.1	< 0.001
Triglycerides (mg/dL)	303.9 $\pm$ 28.7	194.4 $\pm$ 16.9	115.6 $\pm$ 15.9	< 0.001
HbA1c (%)	6.29 $\pm$ 0.68	6.45 $\pm$ 0.86	5.07 $\pm$ 0.57	0.145
Troponin T (ng/mL)	1.77 $\pm$ 0.77	1.68 $\pm$ 0.87	1.46 $\pm$ 0.80	0.433
CK-MB (U/L)	79.8 $\pm$ 32.0	50.4 $\pm$ 18.5	2.6 $\pm$ 1.8	< 0.001
QTc (ms)	439.2 $\pm$ 12.6	399.1 $\pm$ 34.8	400.8 $\pm$ 38.5	< 0.001

p values by Welch's t-test. Healthy controls are shown for reference only. † n = 98 (age missing for 2 patients).

Effect of yoga. After 12 weeks of yoga, all four lipid values improved significantly (Table 2). Triglycerides fell by 30.5%, total cholesterol by 22.6% and LDL by 8.7%, and HDL rose by 19.5%. SDNN, RMSSD, LF/HF ratio and BMI did not change significantly.

Table 2. Parameters before and after 12 weeks of yoga in obese MI patients (n = 50)

Parameter	Before yoga	After yoga	Change (%)	p
BMI (kg/m ²)	27.5 $\pm$ 1.9	27.7 $\pm$ 1.9	+0.9	0.579
SDNN (ms)	69.5 $\pm$ 5.8	68.7 $\pm$ 6.0	-1.2	0.502
RMSSD (ms)	18.0 $\pm$ 4.9	17.9 $\pm$ 5.0	-0.8	0.871
LF/HF ratio	2.72 $\pm$ 0.46	2.76 $\pm$ 0.48	+1.5	0.677
LDL (mg/dL)	166.2 $\pm$ 13.6	151.8 $\pm$ 17.4	-8.7	< 0.001
HDL (mg/dL)	33.9 $\pm$ 3.1	40.5 $\pm$ 1.6	+19.5	< 0.001
Total cholesterol (mg/dL)	260.2 $\pm$ 11.2	201.3 $\pm$ 11.0	-22.6	< 0.001
Triglycerides (mg/dL)	300.5 $\pm$ 27.8	209.0 $\pm$ 19.0	-30.5	< 0.001

Values are mean $\pm$ SD; p values by paired t-test.

Correlation. In all 200 MI patients taken together, higher BMI was linked with lower RMSSD ($r = -0.81$), SDNN ($r = -0.42$) and LF/HF ratio ($r = -0.46$) (all $p < 0.001$).

Discussion

In this study, obese MI patients had much lower SDNN and RMSSD than non-obese MI patients. This shows reduced vagal control of the heart. Similar results were found by Karason et al., who reported lower HRV in obese subjects, which improved after weight

loss [4]. Because low HRV after MI predicts mortality [7,8], obese MI patients may be at higher risk. The LF/HF ratio was lower in obese patients, which was not expected. This ratio is not a reliable measure of sympathovagal balance [18], so SDNN and RMSSD are more dependable.

Results

Obese vs non-obese MI patients. Obese MI patients had lower SDNN, RMSSD and LF/HF ratio than non-obese MI patients (Table 1). RMSSD in obese patients was about one-third of the non-obese value. LDL, total cholesterol, triglycerides, CK-MB and QTc were higher and HDL was lower in obese patients (all $p < 0.001$). HbA1c and Troponin T were similar in both groups. The sex distribution was similar, and obese patients were about 4 years older.

Obese patients also had a worse lipid profile, higher CK-MB and a longer QTc (439 vs 399 ms). A longer QTc may mean a higher risk of arrhythmia.

HRV did not change after 12 weeks of yoga. Christa et al. found improved HRV after a similar yoga programme in post-MI patients [11], but a meta-analysis by Posadzki et al. found no clear effect of yoga on HRV [10]. A longer programme may be needed to see a change in HRV.

Yoga clearly improved the lipid profile. Similar results were found by Manchanda et al. in patients with coronary artery disease [13] and in the meta-analysis by Cramer et al. [14]. BMI did not change, so the benefit was not due to weight loss. Yoga is low-cost, well accepted in India and safe after MI [12].

Limitations. The yoga group had no separate control group, so medicines such as statins may have added to the lipid change. Adherence and diet were not recorded. The study was done at one centre with a small yoga group, and only short-term HRV was measured.

Conclusion

Obese MI patients have lower HRV, a worse lipid profile and a longer QTc than non-obese MI patients. Twelve weeks of yoga with standard care improved the lipid profile but did not change HRV or BMI. Yoga can be used as a simple, low-cost add-on after MI. Larger and longer controlled studies are needed.

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