7.0 DISCUSSIONS

This is the first study to date to assess the effectiveness of IAYT in post-MI patients with left ventricular dysfunction in India. The study also investigates for the first time the detailed usage of CDS, HAM-A, and DASI questionnaires in Indian cardiac patients. Cardiac function was the primary outcome of this study and LVEF was taken as a measure of cardiac function. A non-significant improvement of LVEF in the yoga practitioners following 12 weeks of supervised practice as compared to control group participants was observed. Our results are in contrast with that of Sadeghi et al., whose work on cardiac rehabilitation for left ventricular dysfunction patients, noticed a significant rise in the LVEF following 8 weeks of exercise training involving treadmill and ergo meter (Sadeghi et al., 2013). We speculate this contrast in results in analyzing LVEF activity could be due to more intense activity in the Sadeghi et al study while our protocol was less intense. Studies have documented improved left ventricular dysfunction when yoga therapy was coupled with standard medical therapy in patients with cardiac failure (Joshi et al., 2011). Joshi et al. investigated the effect of improved LVEF on the long-term prognosis of patients with ischaemic left ventricular systolic dysfunction, where they have indicated that a threshold of 8% improvement in the LVEF could be considered significant for the patient survival and heart failure hospitalization even though the clinical meaningful improvement of LVEF is considered to be higher than 5% in most of the studies (Breathett, Allen, Udelson, Davis, & Bristow, 2016; Joshi et al., 2011). The reasons for lack of statistical significance in LVEF, as documented in previous studies include inconsistent timing of repeat LVEF assessment, time of symptom onset to a successful intervention, anterior location of the infarct, female sex and underestimation by the echo technician, especially in large volume chambers (Gibson, 1981; Heikki et al., 2018). We show that the cardiac rehabilitation program, implemented through "yoga practice" showed significant reduction in CDS and HAM-A scores and increase in quality

of life via the DASI and METs scores in Indian cardiac patients. The concept of cardiac rehabilitation is less known in the eastern part of the world, including India. Furthermore, in places where it is offered, the patient reference and participation is not encouraging. Yoga practice is culturally better accepted in India and patients adhere to the protocol well (Tiwari & Pandey, 2013). A study on IAYT practice in post CABG patients showed a significant improvement in LVEF after 6 months and 1 year after surgery (Raghuram et al., 2014). In our study, LVEF outcomes were not similar to those in the Raghuram et al study. There was a very slight improvement (1.6%) in the LVEF but did not reach statistical significance when compared with the control. However, it would be interesting to know and investigate if the 1.6% change is indicative of a clinically important change to acute MI patients.

Research findings suggest that both physiological and psychological components have to be focused simultaneously and modification of one risk factor may not translate automatically to benifit the other (Suchday, Dziok, Katzenstein, Kaplan, & Kahan, 2012). Rehabilitation program in cardiac conditions attempts to improve (a) depression and anxiety (b) quality of life and exercise capacity and (c) cardiac function by using yoga practice integrated into lifestyle therapy. These parameters can be assessed by different questions and their scoring patterns.

Depression and Anxiety: The effect of IAYT on the psychological status of our patients as assessed by CDS and HAM-A was improved substantiating studies which demonstrated 40-70% reduction in depression, anxiety, and hostility following cardiac rehabilitation (Contractor, 2011). Yoga is known for its positive psychological effects, and as its definition states " yoga is suppression of modification of mind". Patients perceived that practicing yoga and meditation help calm thoughts, emotions and ease physical discomforts, supporting its emerging beneficial role in health issues like hypertension and CHD (Hartley et al., 2014; Longfellow, 1993; Pullen, 2010).

The QOL and exercise capacity: Our study population exhibited a statistically significant improvement in the DASI and its derivative, MET scores, following 12 weeks of supervised IAYT as compared to the control group. This is consistent with the results where home-based rehabilitation was tried in CHD patients, in which, there was a significant improvement in the participants of the rehabilitation group, even though the quantum of improvement was comparatively low in the aged population (between 66-75 Years of age) (Oerkild, Frederiksen, Hansen, & Prescott, 2012). Energy expenditure has been estimated for various activities of daily living and for alternative forms of physical activities. Tai Chi Chuan, one of the Chinese martial arts demand a MET level of around 4.6 which is equivalent to walking on a flat surface at a speed of 3.7 miles per hour. Yoga, which shares many similarities with Tai Chi, expenses up to 3.3 MET for an entire session of 1 hour while achieving 50% to 77% of maximum predicted heart rate. This lower level of physical activity would be a better alternative for the sedentary individuals and patient population (Hagins, Moore, & Rundle, 2007). Yoga-based rehabilitation is low impact, does not demand any special types of equipment, requires less space for its practice compared to the conventional aerobic exercises and has limited harmful side effects, and hence may be a better alternative to conventional exercises for patients considered for cardiac rehabilitation. Yoga emphasizes more on relaxation, meditation, and awareness, which makes it a pleasurable exercise experience rather than strenuous and may be encouraging to the practitioners for long-term adherence to practice (Hagins et al., 2007; Lau et al., 2015). There was a good improvement in bodily pain, general health perception, physical and social functioning and overall on the health-related QOL in the Chinese participants with metabolic syndrome who completed a 12 week yoga training session (Lau et al., 2015).

We speculate that the supervised yoga training by the health care professionals could have helped the patients of the yoga group overcome apprehension. This, in turn, would have motivated the patients to attempt activities, which they would not have done otherwise, even though their health status would permit. This could be one of the reasons for the statistically significant difference in the QOL outcome between the groups in our study.

Even though the lipid profile of patients who practiced IAYT was improved compared to the control group, the values did not reach statistical significance. Our results are consistent with the previously published study exploring the effects of yoga based cardiac rehabilitation in post CABG patients(Raghuram et al., 2014). Exercises lead to increase in the levels of HDL cholesterol and thereby preventing further atherosclerotic changes (Longfellow, 1993). The low levels of physical activity achieved with the practice of yoga is suitable to achieve metabolic fitness with an improvement in indices such as lipid profile and insulin resistance (Hagins et al., 2007). Lau et al. who used 60 minutes yoga sessions over a 12 week period indicated that longer training durations would help to increase the levels of serum HDL especially in patients with a higher baseline HDL levels (Lau et al., 2015). Yoga practice improved metabolic parameters including serum triglycerides in Chinese adults (Lau et al., 2015). However, in the Multicenter Lifestyle Demonstration Project (MLDP) focusing on exercise and stress management, conducted in the US, the HDL cholesterol and triglycerides did not show much improvement from the baseline over a period of 1 year (Koertge et al., 2003).

In another study involving the Multisite Cardiac Lifestyle Intervention Program (MCLIP), 12 weeks of lifestyle modification and stress management showed lower perceived stress, increased psychological well-being with a reduced dietary fat intake. This better stress management was related to reduced triglyceride, total cholesterol/HDL-C ratio and Haemoglobin Alc in CHD

patients with a history of diabetes (Jennifer J.Deubenmier, Nancy Mendell, Terri Merritt-Wonden, Joli Studley, 2007). Bandura et al. suggested this improvement in psychological well-being may lead to improved eating behavior which further contributes to improved biochemical profile (Pischke et al., 2008). Previous studies have demonstrated inconsistent effects of exercise on LDL cholesterol and that following a couple of months of aerobic exercise, LDL cholesterol in general did not change significantly, but those sub-fractions of LDL which were atherogenic did. Lower baseline levels of triglycerides yielded less improvements following aerobic exercise training. Factors contributing to the response of triglycerides and HDL cholesterol to exercise training include body weight, body fat, cardiovascular fitness, training status, regional lipid concentration, dietary changes and genetic factors. Blood sample collection time, blood test technology as well as exercise time could be additional contributing factors (Wang & Xu, 2017).

Mechanism: Physical training improves fibrolysis and myocardial perfusion which in turn improves systolic function as well as ejection fraction as a consequence of improvement in the myocardial strength (Sadeghi et al., 2013). Studies proposed a mechanism on how yoga could reduce stress arousal. Chronic stress, psychological distress, depression, and anxiety have a vital role in the pathogenesis of atherosclerosis. Yoga leads to a reduction in the sympathetic activity which explains the improvement in anxiety, depression, perceived stress and negative affect. Correction in mindset by regular introspection at physical, mental, emotional and intellectual levels is achieved through autonomic regulation with yoga practice. Yoga helps modulation of neuro-endocrine-immunologic pathways and affects the hypothalamo-pituitary- adrenal (HPA) axis (Raghuram et al., 2014). Physical postures of yoga, combined with meditation and breathing exercises decrease the sympathetic activity in turn leading to a reduction in the ventricular filling pressure (Pullen, 2010). The proposed mechanism may help reduce the load on the myocardium.

In addition to the predominance of the parasympathetic state, yoga may also promote effective extraction of oxygen by peripheral tissues. When a muscle is stretched, the oxygen consumption increases (Limonta, Cè, & Esposito, 2012). An 8-week health effects of yoga training showed increased muscle strength (31%), muscular endurance (57%), flexibility (88%), oxygen uptake (7%) and reduced cardiovascular risk in healthy adults (Hari Krishna et al., 2014; Tran, Holly, Lashbrook, 2001).

8.0 APPRAISAL

8.1 SUMMARY OF THE FINDINGS

A comprehensive review of available research evidence in the field of cardiovascular health through a bibliometric analysis was performed. Compilation and an expert validation of a yoga module for the current RCT was performed. The post-MI patients who satisfied the selection criteria were randomly assigned to two groups, namely, Group 1- yoga and Group 2- control. The yoga group received one hour supervised yoga module, which was previously validated. The patients were encouraged to practice the same one hour yoga, as per the module, at home during the other days of the week. The control group received standard care that included pharmacological treatment and the instructions of the cardiologist. There was no statistically significant difference in LVEF between the two groups. However, the yoga-practicing group showed significant reduction in depression, anxiety, and a significant increase in quality of life scores at 3 months compared to control. Control and yoga practicing groups did not differ significantly in the lipid levels.

8.2 CONCLUSION