

was prepared as an intervention to target the patients with left ventricular failure following myocardial infarction. The module which was then validated by experts, was successfully implemented in the clinical trial complementary to standard care of cardiac patients.

3.0 REVIEW OF SCIENTIFIC LITERATURE YOGA AND CARDIAC HEALTH

3.1 DIAGNOSTIC CRITERIA

History and physical examination play a vital role in the diagnosis of left ventricular dysfunction and its underlying cause. It is a challenge to diagnose the condition based on the symptomatology, in which circumstance, objective measures play an important role (Ahmed Ali, 2009).

Cardiac function is a predictor of prognosis and mortality in CAD patients. LVEF is a good indicator of cardiac performance. The LVEF could be measured using various techniques, among which the most preferred technique is the trans-thoracic, two dimensional echocardiography. It is non invasive, widely available, quite comfortable for the patient, safe and gives quality images of the heart and the associated structures. It provides an estimate of systolic and diastolic functions of the heart (Ahmed Ali, 2009). The American Society of Echocardiography (ASE) gives a cutoff value of 55% for LVEF as measured on a echocardiogram and values less than this to be considered abnormal. A large cohort study involving 2300 European whites and Indian Asian subjects reported a cutoff value of 52%. Reduced left ventricular function is associated with unfavorable long term prognosis in CAD patients (Raghuram et al., 2014). Edelman et al. adapted the ASE guidelines to perform echocardiography, where Simpson's model of discs was used to demonstrate left ventricular ejection fraction. Two categories of patients were detected, namely, systolic heart failure

(SHF) and Heart Failure with Normal Ejection Fraction (HFNEF). The cut off for echocardiographically determined LVEF was set at 50% (Edelmann et al., 2011).

The New York Heart Association guidelines classifies the severity of heart failure under 4 classes based on the patients' symptoms (Pollentier et al., 2010).

Class	Patient Symptoms
Class I (Mild)	No limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, or dyspnea (shortness of breath).
Class II (Mild)	Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in fatigue, palpitation, or dyspnea.
Class III (Moderate)	Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes fatigue, palpitation, or dyspnea.
Class IV (Severe)	Unable to carry out any physical activity without discomfort. Symptoms of cardiac insufficiency at rest. If any physical activity is undertaken, discomfort is increased.

There is a poor correlation between the symptoms and severity of cardiac dysfunction. Mild symptom should not be understood as minor cardiac dysfunction. Similar symptoms may be experienced by the patients at various values of LVEF (Task et al., 2005). Stress echocardiography, radio nuclide imaging and Cardiac Magnetic Resonance imaging (CMR) are other noninvasive imaging techniques that could be considered in case conventional echocardiographs does not provide valuable information (Task et al., 2005).

3.5 THERAPY AVAILABLE

3.5.1 PHARMACOLOGICAL

Pharmacological management of left ventricular dysfunction revolves around medication regimes which includes Angiotensin Converting Enzyme (ACE) inhibitors, diuretics, β blockers, digitalis, calcium channel blockers, angiotensin II receptor blockers, potassium supplements and cholesterol lowering drugs. Surgeries will be in an attempt to rectify the etiology of heart failure (Pollentier et al., 2010). It has been documented patients with left ventricular dysfunction treated with ACE inhibitors, beta blockers and aldosterone antagonists reported lower rate of morbidity and mortality. In spite of advancements in pharmacotherapy, considerable under treatment still exists in diabetic left ventricular dysfunction patients with normal ejection fraction (Edelmann et al., 2011).

There are new innovations coming up in the field of devices and surgeries as well. In the survivors of MI with left ventricular systolic dysfunction, Implantable Cardioverter-Defibrillators (ICDs) are proven to yield promising results. In a population with severe intractable CHF, left ventricular assist devices are of value as life saving strategy. As a last resort in the management of chronic heart failure, heart replacement surgeries are gaining importance and has partially succeeded. Total artificial hearts are the talk of the day and trials on this are in progress (McMurray, 2002).

3.5.2 COMPLEMENTARY AND ALTERNATIVE THERAPIES

Pharmacological treatment for cardiovascular diseases have various adverse effects and have limited efficacy. Hence there is an upsurge in patients opting for various Complementary and Alternative Medicine (CAM) in an attempt to improve health related quality of life and to prevent recurrent illness. The holistic approach to health and wellness offered by these practices encourage more patient participation and are credited with limited adverse effects (Anderson, 2012).

In the management of cardiovascular diseases, secondary prevention should not be neglected since it plays an important role in effective prophylactic care. Cardiac rehabilitation is a term often used to describe coordinated, multifaceted intervention designed to utilize the cardiac patient's physical, psychological and social functions to the maximum extent. In addition to this cardiac rehabilitation also has a role in reversing the progression of the atherosclerotic process and hence reduce morbidity and mortality (Leon et al., 2005). Cardiac rehabilitation improved the ejection fraction of post MI patients with an initial ejection fraction less than 50%. Studies have documented marked improvements in the exercise capacity of the participants without any detrimental effects on cardiac remodeling (Sadeghi et al., 2013). There have been echocardiographic evidences to demonstrate reverse left atrial remodeling and improved left ventricular diastolic functions with moderate intensity supervised exercise program in patients with a mean age of 70 years, having symptoms of heart failure and LVEF of $\geq 50\%$. Additionally, an improvement of peak Volume of Oxygen consumption (VO₂) and physical quality of life was noted (Kwan & Balady, 2012).

Around 27% to 88% of older adults use CAM to improve their health related quality of life and the majority of them prefer models which incorporate prayer since they view prayer as an essential component of their health behavior. There is a tendency among Asian - Americans adapt eastern practices reflecting their tradition and heritage as health care choices. Recently mind-body therapies have been reported to improve specific cardiovascular risk factors like hypertension and hypercholesterolemia (Anderson, 2012). Tai Chi Chuan, an ancient Chinese martial art, the movement of which is characteristic of slowness, quietness and stillness is a form of low to moderate intensity exercise which could be advocated for long term rehabilitation of patients with heart disease since it produces less ventricular wall

stress and reduce the risk of malignant arrhythmias. It induces relaxation and a feeling of wellbeing apart from an improvement in the quality of life, symptoms and exercise tolerance (Barrow, Bedford, Ives, O'Toole, 2007). Tai Chi could serve as a valuable alternative for high and moderate intensity aerobic exercise regimens traditionally prescribed for heart failure patients. It has been estimated that the energy expenditure in trained individual amounts to approximately 4.6 Metabolic Equivalent (METs) which is equivalent to walking at a speed of 3.7 miles per hour on a level surface. It has the advantage of suitability to a wide range of patient population with various co-morbidities associated with age. It is possible to cater a group of a considerable number of participants at the same time and hence is cost effective (Barrow, Bedford, Ives, O'Toole, 2007; Longfellow, 1993).

Yoga, one of the potential mind body therapies would be a promising therapeutic and health promotional strategy in the management of chronic stress associated with CVD (Innes et al., 2007). The therapeutic aspects of yoga have been used in India to manage hypertension and other chronic disorders since decades (Raghuram et al., 2014). Yoga enhances psychological well being and reduce psychological morbidity by modifying the reactivity to stressors, adapting stress-related coping mechanisms, minimizing the symptoms of anxiety and depression and also reducing episodes of tension, anger and fatigue, improving the quality of sleep and enhancing the quality of life (Innes et al., 2007). It further helps to establish collateral pathways towards health and well-being by breaking the vicious circle of progressive emotional, cognitive, structural and psychological disturbance that would lead to the development and aggravation of the risk of CVD (Pullen, 2010).

A 12 week yoga therapy combined with pharmacological therapy resulted in significant improvement in cardiac function and reduction in cardiac stress, which is reflected in the

reduction of mortality rate. Moderate physical activity in the form of yogasana, pranayama and meditation along with prescribed pharmacological therapy may be considered in patients with stable heart disease. Yoga is comparatively safe with no reported episodes of cardiac symptoms or orthopedic injuries, even in the patient population, during practice (Hari Krishna et al., 2014).

With the practice of yoga, there is a predominance in the parasympathetic activity and an effective absorption of oxygen at the peripheral tissue level, which is because of sustained stretching of muscles involved in asana. Studies have demonstrated that yoga training improves muscle flexibility by 88%, muscular endurance by 57%, muscle strength by 31%, oxygen consumption by 7% and reduces the cardiac risk to a considerable extent in healthy adults (Hari Krishna et al., 2014).

Meditation and relaxation irrespective of whether they are yoga-based or not, has a major contribution in the reduction of subsequent cardiac events following cardiac rehabilitation. There are substantial evidences to demonstrate that exercises combined with meditation and relaxation are superior to exercise alone in this regard. In addition to this, relaxation also helps with the psychological adaptation of the patients (Longfellow, 1993).

A bibliometric analysis was done to evaluate the research evidence of Yoga in the field of cardiovascular diseases as a result of the contemporary lifestyle, under the heading, 'The evidence base of yoga studies on cardiovascular health: a bibliometric analysis'. Yoga's therapeutic potential in the field of cardiovascular health has been explored in a growing number of trials to date, although consolidation of evidence as bibliometric analysis is limited. Bibliometrics is a systematic method for evaluating research output that can help map changes in the interest of the scientific community over time and can provide insights

into both quantitative and qualitative research trends on a specific topic (Khalsa, 2004b). Hence the purpose of present study is to provide a comprehensive review of available research evidence in the field of cardiovascular health through a bibliometric analysis.

MATERIALS & METHOD

DATA SOURCE

An electronic search of Pub Med as a standard bibliographic database was performed through Feb 2015 using the keywords 'yoga' AND 'cardiovascular'. Studies with Yoga as the independent variable and parameters related to cardiac health as the dependent variable were included and exclusion criteria were applied (Figure 19).

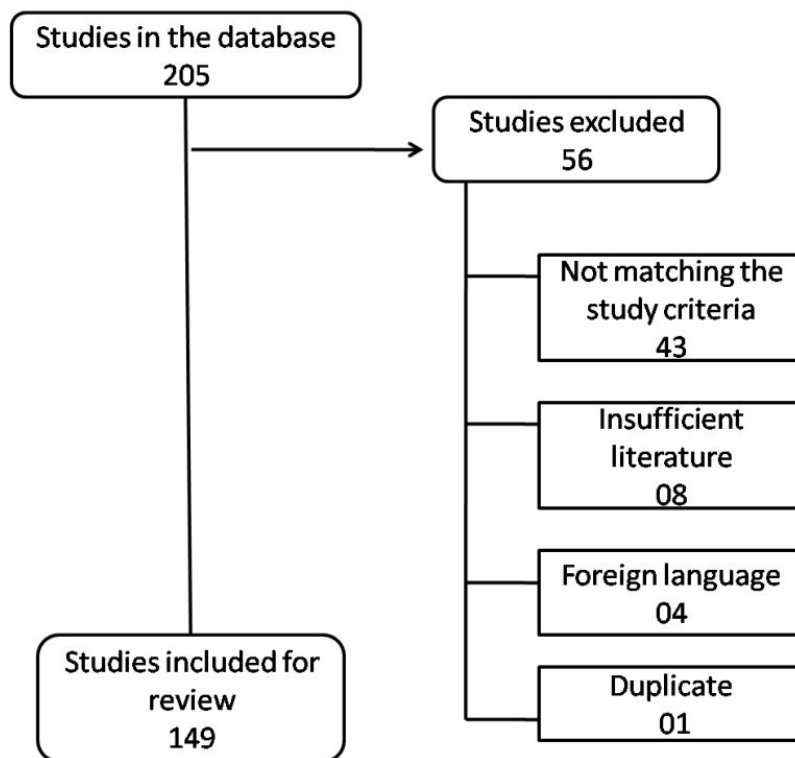


Figure 19: Study selection- Flowchart

The search strategy was built basically by inputting the keywords 'yoga' AND 'cardiovascular'. The country of origin of the article was identified by the first author's

country. After removal of duplicate records, identified abstracts were screened independently by two review authors to determine whether they actually met the eligibility criteria. Selection criteria- The following selection criteria's were applied to include or exclude the studies:

Types of studies:

Each study was evaluated as to the presence of a control group and whether subjects were randomized to different study arms, to yield 3 possible study categories: non-controlled trials, controlled trials, and randomized controlled trials (RCT's). Dissertations, reports or proceedings of meetings, book chapters, articles in foreign language and those not matching with the keywords ie., non-Yoga intervention as well as non- cardiovascular outcomes were excluded. Reports or research letters in journals, publications of case reports, population survey studies and articles with minimum literature availability which were insufficient to categorize have not been included. Though the reviews, meta-analysis, bibliometric analysis, Cochrane reviews and pilot studies have not been included for analysis, they have been reported in the overall review with respect to the year of publication and place of origin.

Types of participants:

Studies of all types of participants were eligible. No restrictions were applied regarding socio-demographic characteristics, age, and gender or health status.

Types of interventions:

Studies were eligible if they assessed the effects of Yoga interventions. Studies were selected irrespective of the tradition, length, frequency or duration of the Yoga practice. There was no restriction on the inclusion of specific practices provided the said practice had a theoretical background of Yoga or has been in Yoga practice traditionally. Intervention components

such as Asanas (Yoga Postures), Pranayama (Yoga Breathing Techniques) and Dhyana (meditation) were included along with educational sessions on the philosophy of Yoga, Yogic diet and /or Yogic lifestyle. Studies involving individual co-interventions along with the intervention that was formally studied were included, but those with multimodal interventions were not. No restrictions were applied to control group interventions.

Data extraction:

Two authors independently extracted data using a standardized data extraction form. All relevant data on study design and settings, types of participants, interventions, and outcome measures were extracted and recorded in the data extraction form. We resolved disagreements by consensus or discussion with the third author.

The structured data extraction form consisted of the following: (a). Publication information (publication year, origin) (b).Data on participants (sample size, gender, age, medical condition)

(c).Intervention (Yoga tradition, program length, intervention components, control intervention)

(d).Outcome Measures & conclusion (changes in blood pressure and blood lipids, cardiovascular mortality, myocardial infarction, CABG, stroke, quality of life, psychological states).

Data analysis:

We performed data analysis using SPSS 17.0. Data were presented by counts, percentages, and frequency.

FINDINGS

A total of 149 publications was identified which met the inclusion criteria for analysis (Fig.

19).

Out of the total of 149 studies, the majority that is 44% were Interventional studies. Among these, the share of randomized control trials was 19%, that of non-randomized control trials, 13% and that of non-controlled trials were 13%. Next in the hierarchy was occupied by systematic reviews which amounted to 26% of the total studies. Apart from these, 15% of them were one time studies while another 15% comprised of miscellaneous ones, namely pilot studies, case reports, meta-analysis, surveys, interviews, scientific statements, bibliometric analysis, Cochrane reviews and letters to the editor, each of which shared a meager percentage (Fig. 20).

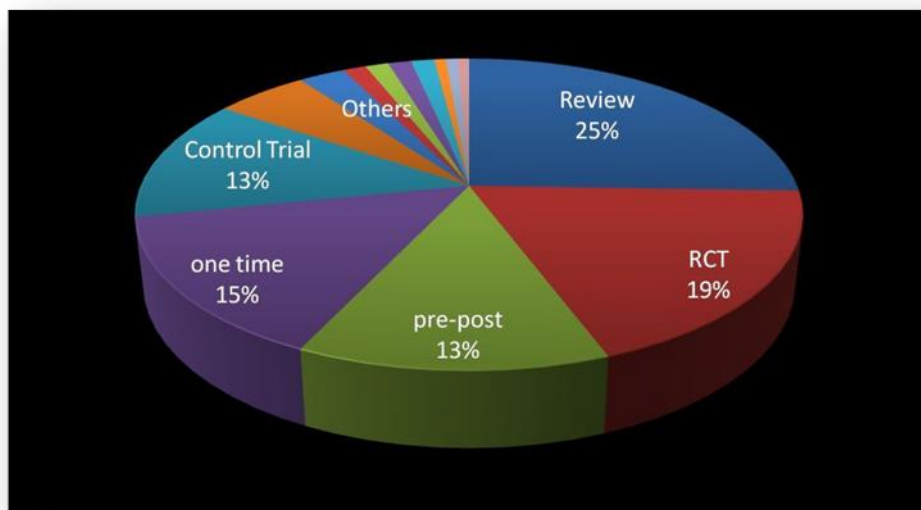


Figure 20. Pie chart demonstrating the study designs incorporated in various studies.

There is an upward trend in the quantum of research work published in this field from the year 1961 onwards. There was a minor upsurge compared to the previous couple of decades, with the total number reaching 17 between the years 1990 and 1999. There was a drastic change in the trend during the subsequent decade, with the number of publications rising up to 59 by the year 2009, with each year consistently contributing to the field of research in this

area, the contribution of the year 2007 being the highest at 10 research papers. With a good beginning of 13 publications in the year 2010, the next five years saw a tremendous growth in the field of research in yoga and cardiovascular health with the number of research articles published crossing the total number of publications of all the previous year's till then reaching the digit '110'. The years 2011 and 2014 were the highest contributors with the number of published articles summing up to 28 and 27 respectively (Fig. 21).

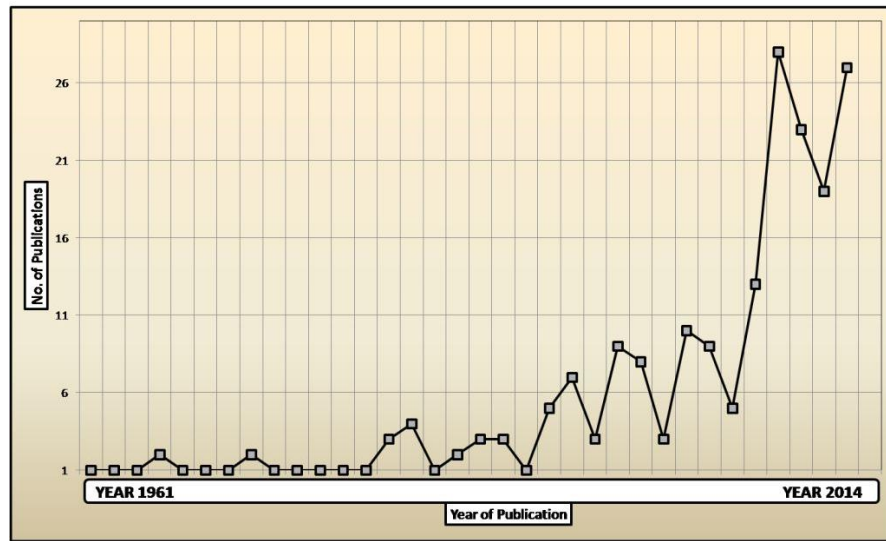


Figure 21: Trend line depicting the yoga research trend in cardiovascular health.

The United States and India share the majority of research contributions in the field of Yoga and cardiovascular health. While the United States has contributed 38%, India has its share of 29% in this area of research. This is followed by the United Kingdom, Australia, and Canada with their contributions of 5%, 4%, and 3% respectively. Others share between 1% -2% each among the remaining 20% of the publications. The origin of another 4% of the published studies could not be traced (Fig. 22A).

Among the published Indian studies, the highest number was mapped to Karnataka which contributed to 30% of the studies. New Delhi (26%) and Pondicherry (24%) were not far behind while Maharashtra's followed with 10%, and the remaining 10% were shared among

Tamil Nadu, Gujarat, and Punjab (Fig. 22B).

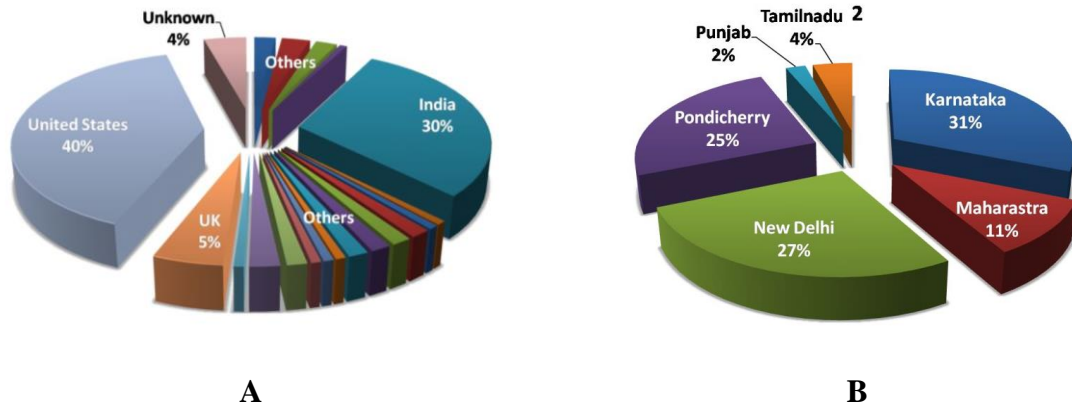


Figure 22: A. Pie chart illustrating the global origin of the studies, B. State-wise distribution

The randomized controlled trials- RCTs

Randomized controlled trials, which are considered the gold standard in experimental studies, was first witnessed by the year 1989. It gained momentum only by the year 2011 when 25% of all publications in the field were RCTs. This was followed by 18% in 2012, 11% in 2013 and 21% in 2014. India contributes the high of 36% RCTs, followed by the US with 32%, while Australia and Korea share 7% each only to leave a meager percentage to be shared among UK, Jamaica, Israel, Brazil, and Iran (Fig. 23A).

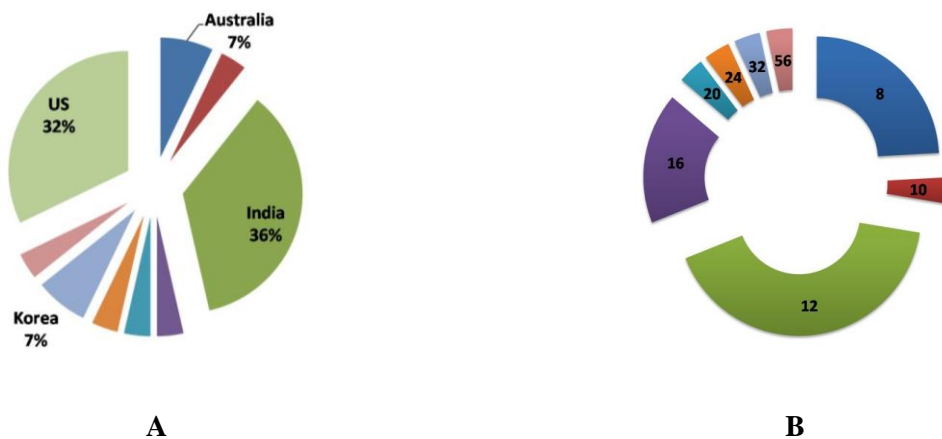


Figure 23: A. Pie chart illustrating the global origin of the RCTs; B. Duration of

intervention.

The origin of 50% of the RCTs in India is from Pondicherry, 40% from New Delhi and 10% from Karnataka. The trials were conducted on a wide range of populations, including healthy adults, hypertensive subjects, diabetics, older adults, heart failure subjects, patients with coronary artery disease, etc. and the duration of trial ranged from 8 weeks and 56 weeks, with the majority of the studies incorporating the intervention duration of 12 weeks (Fig. 23 B.). The majority of the studies incorporated the integrated yoga intervention in combinations of Asanas, Pranayama, and meditation - in a few.

The non-randomized control trials

In a span of over forty years, i.e., between the years 1975 and 2015, we came across 19 non-randomized control trials. The majority of the trials were from the recent 15 years. Six of the 19 trials originated from the United States, while 5 were from India. Healthy Yoga practitioners, hypertensive and geriatric population predominated the study population apart from sedentary people, smokers and those infected with HIV (Fig. 24). Duration of the trial ranged from 0-48 weeks.

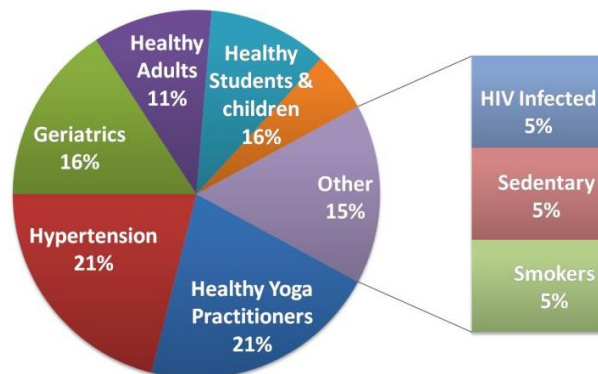


Figure 24. Population included for non-randomized control trials.

The single group studies

Nineteen studies fitting into the single group design category were documented post-1997, with 2011 contributing the maximum number. India tops the list by contributing 14 numbers from Pondicherry, New Delhi, Karnataka, Maharashtra and Tamil Nadu. Pranayama is the most frequently used yoga practice, with 10 out of 19 studies incorporating this along with, asana, meditation, educational sessions and yoga-based lifestyle modifications. The duration of trial ranged from 0-12 weeks. Blood pressure and heart rate, which were assessed in 12 and 11 studies, respectively, were the most evaluated outcome measures.

The onetime studies

Studies carried out over a single time period were categorized as 'one-time' studies. The first such study was documented in the year 1987 and till date, there are 22 such studies in total making up to 15%. India, the United States, and Czechoslovakia respectively contributed 6 (27%), 5 (23%) and 3 (14%) such studies. Most of the studies have been conducted on Yoga practitioners and healthy population while a few were for Duchene Muscular Dystrophy (DMD) children, Parkinson's and dementia patients, the sedentary population as well as runners.

This bibliometric analysis reflects a comprehensive review to date of the clinical evidence on Yoga for cardiovascular health, including reviews, randomized control trials, non-randomized control trials, case reports, and surveys. Out of 149 trials included in the review, only 19 % were randomized control studies. Most of the trials were short-term and conducted on healthy participants. The information gaps in the published literature are highlighted here. There is a lack of reliable, strong evidence on the effects of Yoga on clinical events, blood pressure and lipid levels and for the primary prevention of CVD. There is an increment in the

publications in last one decade, nonetheless, more trials are needed in order to clarify the potential benefits of Yoga for cardiovascular health. 'Previous systematic reviews studied the efficacy of Yoga in the primary and secondary prevention of CVD' (Innes et al., 2007; Jayasinghe, 2004). 'The majority of the identified studies focused on primary prevention, and only a few identified studies investigated secondary prevention. This may reflect under-research on this topic. A population-based study suggested a substantial growth in the use of Yoga as a form of complementary and alternative medicine' (Subramanyam, 1989). Nevertheless, the participants exhibit a trend to utilize complementary and alternative medicine to treat musculoskeletal problems rather than chronic diseases viz. lifestyle disorders. The low prevalence of the Yoga might limit exploration of the therapeutic potential of Yoga.

Ugolini et al, in a bibliometric analysis of the fields on the rehabilitation of cerebrovascular and cardiovascular diseases has come up with similar findings and have reported that the publications in this area increased 8.6 times from the year 1967 to 2008 and after a 20 year period of plateau between 1975 and 1994, there is an addition in the productivity of cardiovascular research in the past 15 years (Innes et al., 2007; Ugolini et al., 2013). Major work in this field has been carried out by the researchers from the United States and India, the findings of which is consistent with the results of Khalsa, 2004 in his study on therapeutic Yoga.

Healthy, and individuals suffering from hypertension are frequently recruited for the trials. Possibly because the physiological effects of Yoga practice as well as the mechanism of action of a majority of practices are beginning to be clear of late, the trials involving healthy population could help accomplish the task. Yoga is known to inhibit sympathetic activity and

facilitate parasympathetic activity. Contrary to conventional exercises, Yoga aims at minimizing oxygen uptake by inducing relaxation. All these practices aim at increasing awareness of the working heart and attempt to reduce heart rate. Therefore, it is commonly adopted by hypertensive individuals as an alternative way to manage such chronic conditions. Blood pressure and heart rate being the direct reflection of autonomic nervous system activity, are the commonly used outcome measures followed by lipid profile and aerobic fitness. Moreover, both of these measures are valid, reliable, non-invasive, easily measurable and cost-effective ones.

CULMINATION

The literature survey indicates that the number of publications in the field of 'Yoga' AND 'Cardiovascular' health has increased rapidly in the last few years. The US and India contributed most of the publications. The study further attempts to represent the outcome focusing on Indian states, mainly because India is a major contributor in this field and also since information about this geographical region is sparse. Analysis, comprising the nation/state helps define its status with regard to its counterparts and helps understand science priorities and disease control strategies in an effort to provide cost-effective and quality control. The literature analysis reveals a deficiency of high-quality studies recruiting patient population in the area of cardiovascular health for Yoga trials. Hence, further high-quality studies investigating the potential effects of Yoga in the management of cardiovascular diseases may be recommended.

LIMITATIONS OF THE ANALYSIS

The Pub Med database was the solitary source of information. Journal publications other than the English language were excluded from the review. Consequently, states with a tradition of

bringing out publications in their native languages may be underrated in this recapitulation. The possibility of bias also exists in not considering several unpublished studies in our review. The primary investigators of some identified studies were contacted to obtain additional methodological information to inform our determination as to whether these surveys should be admitted; all the same, most investigators did not respond to our inquiry emails. We cannot, therefore, avoid the possibility that we may not have included some eligible studies.

IMPLICATIONS OF THE BIBLIOMETRIC ANALYSIS FOR RESEARCH

More high-quality RCTs may be recommended to obtain a definitive response to the inquiry of the strength of Yoga for cardiovascular wellness. Emphasis to better methodological quality should be given in future studies with respect to the design of trials, random sequence generation, group blinding, sample size, sample power and avoidance of bias in the study to improve the methodological quality. Tests should include relevant issues such as morbidity, composite cardiovascular events, and quality of life. Valuations of the cost, cardiovascular-related hospital admissions, and untoward outcomes are likewise called for. Participants from different ethnic groups and from different countries could be considered as part of a more widespread research.

On the basis of the findings of the current study, we advocate an integrated approach towards Yoga incorporating various combinations of asanas, pranayama, kriyas, meditation and relaxation practices along with lectures and advice on Yoga-based lifestyle modifications and diet while addressing the needs of cardiovascular patients. We also recommend an intervention duration of a minimum of 12 weeks for the effects to manifest in such population. Special consideration needs to be given to individual practice as a home program.

Biomarker studies which compare Yoga with standard pharmacological and psychotherapies, and studies of long-term efficacy are needed to fully translate the promise of Yoga in the field of cardiac health. Based on our finding, we proposed a randomized control trial to analyze the effect of yoga on various parameters in post MI patients during their rehabilitation phase. The following section discusses the details of the same.

3.1 TABLE OF SCIENTIFIC RESEARCH ON YOGA RCTs IN THE FIELD OF CARDIOVASCULAR DISEASES

Study No	Study Title	Journal	Year of Publication	Study Design	Intervention	Duration of Intervention	Study Population	Comments
1	Effect of yoga regimen on lung functions including diffusion capacity in coronary artery disease patients: A randomized controlled study.	Int J Yoga	2015	RCT	asana, pranayama, diet, holistic teaching	3 months	CAD patients	significant improvements in all parameters following yoga
2	Randomised controlled trial of a 12 week yoga intervention on negative affective states, cardiovascular and cognitive function in post-cardiac rehabilitation patients.	BMC complement Altern Med	2014	Parallel arm multicentre RCT	asana, pranayama, meditation	12 Week	Post phase 2 cardiac rehab patients	synopsis
3	Additional benefit of yoga to standard lifestyle modification on blood pressure in prehypertensive subjects: a randomized controlled study.	Hypertens Res	2014	Randomised parallel active control	Yoga and lifestyle modification	12 week	pre HTN without any CVD	significant reduction of BP in yoga group
4	Effect of yoga on oxidative stress in elderly with grade-I hypertension: a randomized controlled study.	J Clin Diag Res	2014	open parallel arm RCT	Yoga	3 Months	GRADE -1 HTN	Significant reduction of oxidative stress and increase in antioxidant level in yoga group p=0.001
5	Age-related changes in cardiovascular system, autonomic functions, and levels of BDNF of healthy active males: role of yogic practice.	Age (Dordr)	2014	RCT	Yoga	3 months	healthy	Significant decrement of cortisol; adrenocorticotropic hormone(ACTH); and increment in serotonin, dopamine, and BDNF was noted following yogic practice

6	Preventive Effects of a Three-month Yoga Intervention on Endothelial Function in Patients with Migraine.	Int J prev Med	2014	RCT	Yoga training	12 week	Migrane	significant decreased in plasma level of vascular cell adhesion molecule (VCAM) in yoga group compare with the control group (15.29 ± 2.1 ng/ml vs. 21.70 ± 3.0 ng/ml, P < 0.05)
7	Effect of yoga therapy on heart rate, blood pressure and cardiac autonomic function in heart failure.	Clin Diagn Res	2014	RCT	Yoga therapy	12 week	Heart Failure	Twelve-week yoga therapy significantly improved the parasympathetic activity and decreased the sympathetic activity in heart failure patients (NYHA I&II).
8	Effect of fast and slow pranayama on perceived stress and cardiovascular parameters in young health-care students.	Int J Yoga	2013	RCT	fast and slow pranayama	12 week	health care students	pranayama practice are beneficial in reducing Percieved stress scale -PSS in the healthy subjects but beneficial effect on cardiovascular parameters occurred only after practicing slow pranayama
9	Comprehensive Approach to Lower Blood Pressure (CALM-BP): a randomized controlled trial of a multifactorial lifestyle intervention.	J Hum Hypertens	2013	RCT	Yoga relaxation ,stress management	16 week	hypertensive	Lifestyle and diet modifications based on complementary medicine principles are highly effective with respect to BP control, medication use and cardiovascular risk factors. P=0.0001
10	Effect of exercise therapy on lipid parameters in patients with end-stage renal disease on hemodialysis.	J Lab Physicians	2012	prospective randomised study	hatha yoga Exercises	4 months	end stage renal disease	Hatha yoga exercise has preventive and beneficial effects p=0.001
11	Yoga training improves metabolic parameters in obese boys.	Korean J physiol Pharmacol	2012	RCT	yoga-asana	8 week	obese adolosemt	8-week of yoga training improves body composition and TC levels in obese adolescent boys
12	Bikram yoga training and physical fitness in healthy young adults.	J strength cond Res	2013	RCT	Bikram Yoga	8 week	healthy	short-term yoga training protocol produced beneficial changes in musculoskeletal fitness that were specific to the training stimulus.no changes in handgrip strength, cardiovascular measures, or maximal aerobic fitness

13	The Effects of a Gentle Yoga Program on Sleep, Mood, and Blood Pressure in Older Women with Restless Legs Syndrome (RLS): A Preliminary Randomized Controlled Trial.	Evidence Based Complement Alt Med	2012	RCT	yoga	8 week	restless leg syndrome	yoga group demonstrated significantly greater improvements than controls in multiple domains of sleep quality and mood, and significantly greater reductions in insomnia prevalence, anxiety, perceived stress, and blood pressure.
14	Effects of an 8-month yoga intervention on arterial compliance and muscle strength in premenopausal women.	J sports Sci Med	2012	RCT	astanga yoga	8 months	healthy premenopausal	The 8 month Yoga training did not affect arterial compliance of the large and small arteries. None of the cardiovascular variables were changed by the Yoga intervention.
15	Non-pharmacological Interventions in Hypertension: A Community-based Cross-over Randomized Controlled Trial.	Indian J community Med	2011	RCT	yoga, walking, exercise	8 week	prehypertensive, hypertensive	Physical exercise, salt intake reduction, and yoga are effective non-pharmacological methods for reducing blood pressure in young pre-hypertensive and hypertensive adults
16	Effects of yoga exercise on serum adiponectin and metabolic syndrome factors in obese postmenopausal women.	Indian J community Med	2012	RCT	yoga	16 week	obese postmenopause	yoga exercise improves adiponectin level, serum lipids, and metabolic syndrome risk factors. yoga exercise will be effective in preventing cardiovascular disease caused by obesity
17	A comparative study of slow and fast suryanamaskar on physiological function.	Int J Yoga	2011	RCT	Suryanamaskar	6 months	healthy school children	SN has positive physiological benefits
18	Yoga respiratory training improves respiratory function and cardiac sympathovagal balance in elderly subjects: a randomised controlled trial.	BMJ Open	2011	RCT	bhastrika	4 months	Healthy	Respiratory yoga training may be beneficial for the elderly healthy population p=0.001
19	Association of fructosamine to indices of dyslipidemia in older adults with type 2 diabetes.	Diabetes metab Synd	2011	RCT	Yoga	8 week	Type 2 DM	Significant result p=0.001
20	Effect of an office worksite-based yoga program on heart rate variability: a randomized controlled trial.	BMC public Health	2011	parallel arm RCT	asana, vinyasa pranayama, dhyana	10 week	sedentary office workers	Synopsis

21	Effect of integrated yoga practices on immune responses in examination stress - A preliminary study.	Int J Yoga	2011	Preliminary RCT	Integrated Yoga	12 week	healthy 1 st year MBBS students	Yoga resists the autonomic changes and impairment of cellular immunity seen in examination stress.P= 0.01
22	A new educational film control for use in studies of active mind-body therapies: acceptability and feasibility.	J Altern Complement Med	2011	RCT	yoga (vs educational film as control)	8 week	post menopause with CV risk	Educational film was more attractive
23	Yoga lifestyle intervention reduces blood pressure in HIV-infected adults with cardiovascular disease risk factors.	HIV Med	2010	prospective RCT	yoga practice	20 week	HIV infected adults with CVD risk	yoga is a low-cost, simple to administer, nonpharmacological, popular behavioural intervention that can lower blood pressure
24	Benefits of yoga for African American heart failure patients.	Med Sci Sports Exerc	2010	RCT	yoga therapy	2 months	heart failure-african american	yoga therapy offered benefits to HF patients by improving cardiovascular endurance, QoL, inflammatory markers, and flexibility. P=0.001
25	Community based yoga classes for type 2 diabetes: an exploratory RCT.	BMC Health Ser Res	2009	Exploratory RCT	yoga	12 week	type 2 DM	Non significant
26	Effects of Hatha yoga and Omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion.	J Altern Complement Med	2004	RCT	asanas, pranayama, Omkara meditation	3 months	healthy	Yogic practices for 3 months resulted in an improvement in cardiorespiratory performance and psychologic profile. P=0.05
27	Effects of exercise training on cardiorespiratory function in men and women older than 60 years of age.	American J Cardiol	1991	RCT	yoga	14 months	older adults	Slight improvement
28	Cardiovascular and behavioral effects of aerobic exercise training in healthy older men and women.	J Gerontol	1989	RCT	Yoga	4 Month	older adults	Non significant

Table 1: Summary table of scientific research on yoga RCTs in the field of cardiovascular disease