



*Review*

## **Integrative cardiology-state of the art of mind body therapies for the treatment of cardiovascular disease and risk factors**

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**Abstract:** Mind-body therapies are a heterogeneous group of interventions that seek to improve multiple aspects of somatic health by focusing on interactions between mental factors and physiological functions. There is a growing interest in modern Western culture in these forms of alternative medicine. Most of these therapies exert their effects via stress control. Induction of the relaxation response via neurohormonal, endocrine and immunological pathways may have beneficial effects in a variety of conditions, including oncological, neuropsychiatric and cardiovascular pathologies. Several randomized controlled trials have produced promising results, supporting a complementary role of mind-body therapies for both the prevention and treatment of the most prevalent cardiovascular problems.

**Keywords:** alternative medicine; hypnosis; meditation; qigong; yoga

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### **1. Introduction**

The bidirectional relationship between the mind and the body's organic functions is well documented. Although the original meaning of the phrase “mens sana in corpore sano” differs slightly from its modern interpretation, this concept is nonetheless well accepted in Western society. Good organic health is an important starting point to ensure feelings of wellness, joy and creativity, while fatigue and pain are enemies of clear thinking. Even the concept of health, defined as one's own feeling of wellness, is somewhat subjective: “Health is a state of complete physical, mental, and

social well-being and not merely the absence of disease or infirmity” [1]. Conversely, mental processes directly influence at least some aspects of organic health. Tensional headache, takotsubo cardiomyopathy, anorexia nervosa, certain forms of arterial hypertension and irritable bowel syndrome are clear examples of how mental dysfunction can have devastating physiological effects.

Western societies, particularly in urban communities, are characterized by growing levels of stress, pollution and noise, which in addition to producing chronic sensations of discomfort, also affect our organic health. For example, noise has been shown to have deleterious effects on cardiovascular health. A recent study in a mice exposed to noise revealed that this stimulus induced vascular dysfunction, primarily via the generation of reactive oxygen species (ROS), that resembled the alterations seen in hypercholesterolemia, arterial hypertension, diabetes mellitus and in chronic smokers [2]. Stressors of all types trigger a cascade of adaptive physiological mechanisms, including the release of adrenaline and cortisol and increases in blood pressure, heart rate and glucose levels that prepare the body for an urgent “fight or flight” reaction. This is a short-term response that is induced in situations of danger. However, when activated chronically, it can have negative effects on cardiovascular, immune and endocrine function. It is therefore reasonable to assume that techniques that induce a relaxation response may help to minimize this damage.

There is a growing interest in Western culture in techniques that may help prevent sickness by modifying various aspects of behavior, including nutrition, stress control and positive thinking. Many of these techniques are popularized by passing trends, without necessarily providing clear health benefits. Nonetheless, most are innocuous and may constitute useful substitutes for other potentially more harmful behaviors. In a European survey [3], 25.9% of the study population reported using some complementary and alternative medical approaches (including mind-body therapies [MBTs]) to treat a variety of health problems, the most common of which were skin conditions and back and neck pain. In most cases, alternative therapies were used to complement conventional biomedical treatment. Complementary medicine was used less frequently to treat cardiovascular disease and diabetes, which were predominantly treated with conventional therapies.

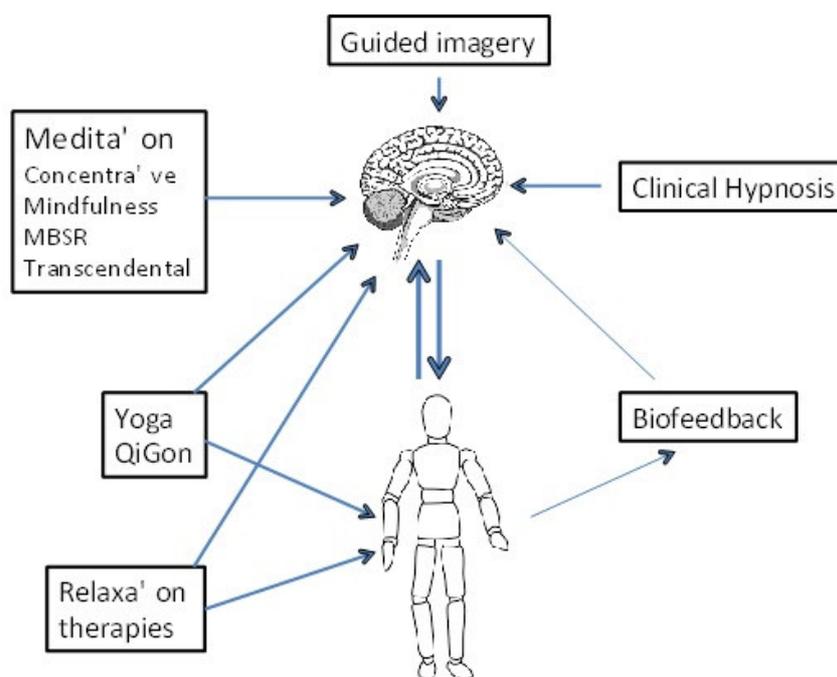
Here, we review the scientific validity and cost effectiveness of some of the most commonly used mind-body therapies.

## **2. Concept and types of mind-body therapies**

Mind-body therapies (MBTs) are based on the influence of the mind on physical functions, and target this relationship in order to treat or alleviate somatic diseases. One mind-body modality that both patients and health professionals often experience, and in many cases unawares, is the placebo effect [4], which can significantly interfere with clinical assays, diminishing the difference between therapeutic and control groups. The placebo effect demonstrates that mere trust in the benefits of a supposed medical treatment is associated with quantifiable positive effects in patients who receive no treatment at all.

In the literature, the term “mind-body therapy” encompasses a broad array of techniques, for which no defined nomenclature exists. This complexity, together with the diversity of methodologies used to apply these interventions, significantly complicates meta-analysis of medical evidence. Mind-body therapies include yoga, meditation, mindfulness-based stress reduction (MBSR), hypnotherapy, biofeedback and guided imagery (Figure 1). As evidenced by a growing body of

medical literature, these techniques are commonly used as complementary therapies to treat a range of pathologies, including chronic pain, cancer, psychiatric, digestive and cardiovascular disorders.



**Figure 1.** Types of mind-body therapies.

### 2.1. Meditation

Meditation is the practice of intentional attention, the aim of which is to increase mental awareness and clarity of mind (concentrative meditation) or to acquire a greater awareness of thoughts, sensations, and feelings as they pass through the mind moment by moment (mindfulness meditation). In 1979, Jon Kabat-Zinn and colleagues at the University of Massachusetts Medical Center developed a structured 8-week program called Mindfulness-Based Stress Reduction (MBSR). This evidence-based intervention teaches mindfulness meditation combined with breath work, yoga, and other relaxation methods, and includes techniques such as mantra meditation, transcendental meditation, and Zen Buddhist meditation [5]. Mindfulness meditation has a number of demonstrated psychological benefits, including significantly improved executive attention, recognition and labeling of emotions, and self-awareness. In addition, practitioners show improvements in somatic stress-related conditions such as psoriasis, type 2 diabetes mellitus, rheumatoid arthritis, and chronic lower back pain. Improvements in emotional well-being and quality of life have also been reported among patients with chronic illnesses [6]. According to the 2007 National Health Interview Survey, over a 12-months period 9.4% of adults practiced meditation in the US [7].

## 2.2. *Yoga*

The word *yoga* is derived from the Sanskrit word *yuj* meaning “union”. The practice of yoga focuses on the union of mind, body, and spirit through the use of mindfulness of breathing (*pranayama*) and body postures (*asanas*), among others, to cope with stress and reduce pain. It is one of the most practiced modalities among adults in the US. The 2007 National Health Interview Survey found that 6% of adults had used yoga for health purposes within the previous 12 months [7].

## 2.3. *Qi-gong*

This is a traditional Chinese technique consisting of relaxation, meditation and breathing exercises combined with specific postures and slow circular movements. It shares several features and a common origin with tai-chi, and when practiced at speed is also considered a combat and self-defense modality [8]. Marginal use of both modalities was reported in the 2007 National Health Interview Survey.

## 2.4. *Biofeedback*

Biofeedback is the use of electronic devices to measure physiological processes and provide the user with corresponding feedback, based on which they can control these processes for therapeutic purposes. Feedback can be auditory, visual, kinesthetic, or multimodal [9]. The objective is to establish conscious control over autonomic nervous system functions such as peripheral temperature, heart rate variability, electrodermal, muscular, respiratory and brain activities. With time, this control can be achieved without the assistance of a device. While the development of several low-cost, portable technologies has made these techniques more accessible, their use remains limited (0.2%) [7].

## 2.5. *Clinical hypnosis*

Hypnosis can be defined as an agreement between a health care professional (the hypnotist) and a client or patient to participate in a psychotherapeutic technique whereby the hypnotist provides suggestions to induce changes in sensation, perception, cognition, affect, mood, or behavior [10]. In the state of hypnosis, peripheral attention decreases, attention is intensified, and the patient becomes more receptive to new ideas and associations [9]. The efficacy of hypnosis has been demonstrated in the treatment of several conditions, including addiction (smoking cessation), obesity and anxiety.

## 2.6. *Guided imagery*

This technique involves the evocation of different senses (sight, sound, taste, touch, smell, movement), and shares many features with clinical hypnosis, but is less invasive [9].

## 2.7. *Relaxation therapy*

Based on the concept of the relaxation response [11], the objective of relaxation therapy is to reduce both mental and physical tension, theoretically minimizing the sympathetic response, which

in turn decreases oxygen demand, slows the heart rate and lowers blood pressure [12]. Relaxation therapy may incorporate other techniques such as deep breathing, guided imagery, progressive relaxation, meditation, yoga, self-hypnosis and biofeedback.

While these are just some of the most commonly used technics, many others are described in the literature (e.g., music and art therapies, deep breathing exercises). Many are used in concomitantly, or in combination with other methodologies. The resulting heterogeneity significantly complicates the comparison of medical data.

### 3. Mind-body therapies applied to cardiovascular disease

Below we will discuss separately the evidence supporting the efficacy of mind-body therapies on cardiovascular risk factors (diabetes, obesity, metabolic syndrome, smoking, inflammation) and their therapeutic use in established cardiac disease (Table 1).

**Table 1.** Summary of effects observed in different RCTs and meta-analyses in mind-body therapies. SBP: systolic blood pressure; DBP: diastolic blood pressure.

Intervention	Significant positive effect	No significant change
Tai-Chi	SBP (15,16, 24,30)	HR (30)
Qigong	DBP (15,16,24,30)	VO <sub>2</sub> max (30,33)
Yoga	Weight, waist circumference (24,26) HbA1c, insulin resistance, fasting blood insulin (24,26) TG, HDL-C, LDL-C (24,30) BNP (30,33) 6mwt (30,33)	Catecholamine levels (33) Fasting glucose, insulin sensitivity index (25) LDL-C, HDL-C, TG (25)
Slow controlled breathing	SBP (17) DBP (18)	SBP (18)
Meditation	SPB (19,32) DBP (19) Fasting blood glucose and insulin levels (23) Myocardial infarction, stroke, mortality (32)	Lipoprotein levels (23) High sensitivity C-reactive protein (23) Body mass index (23) DBP (32)
Biofeedback	SBP (21,22) DBP (21,22)	SBP (20) DBP (20)

HR: heart rate; VO<sub>2</sub> max: peak oxygen uptake; TG: triglycerides; BNP: B-type natriuretic peptide; 6mwt: 6-minute walk test.

### 4. Cardiovascular risk factors

Although current European and American guidelines for cardiovascular disease prevention contain no specific recommendations relating to the use of mind-body therapies [13,14], there is a growing body of evidence suggesting that these approaches may have positive effects on certain individual risk factors.

#### 4.1. Hypertension

Stress is a known inducer of hypertension. As such, it is reasonable to postulate that techniques that focus on stress reduction, such as MBTs, may have therapeutic utility.

A meta-analysis of 2 randomized controlled trials (RCTs) comparing the effects of qigong combined with antihypertensive drugs versus drugs alone [15] suggests a beneficial effect of qigong (weighted mean difference: Systolic blood pressure [SBP]  $S12.1$  mmHg, 95% confidence interval [CI95%]  $S17.1-S7.0$ ; diastolic blood pressure  $S8.5$  mmHg, CI95%  $S12.6-S4.4$ ). Another meta-analysis of the effects of qigong [16] found that self-practiced qigong was more effective in decreasing SBP and DBP than no treatment at all, but was not superior to drug treatment, suggesting that qigong could enhance the beneficial effects of pharmacotherapy on symptoms and quality of life. Stress is a known mediator for hypertension. It is reasonable to think that techniques that focus on stress reduction, like MBTs will have therapeutic utility.

Two RCTs have investigated the effects of slow controlled breathing. In a study by Elliot et al. [17] of 149 patients in 5 centers, 77% received drug therapy, while 50% received a device to guide slow breathing. The authors observed significant differences in SBP between groups that were correlated with the time spent practicing the controlled breathing intervention. In another study [18] 65 patients with hypertension, who were either unmedicated or were taking antihypertensive drugs, were randomized into 2 groups: Patients in the intervention group received a device, for use at home, to aid breathing control, while those in the control group received a walkman with which to listen to quiet synthesized music. MAP and DBP were significantly lower in the intervention group, while SPB was reduced, although this effect was not significant. No significant changes were observed in the control group.

The effects of transcendental meditation in hypertension were reviewed by Anderson et al. [19] in a meta-analysis of 9 RCTs, 4 of which involved hypertensive patients. Transcendental meditation was associated with a 4.7 mmHg decrease in SBP and a 3.2 mmHg in DBP, with similar results observed in both normotensive and hypertensive patients.

Greenhalgh and colleagues [20] conducted a systematic review to assess the evidence for the long-term effectiveness of biofeedback on essential hypertension in adults. They found no clear benefits, and noted the marked heterogeneity across trials and the absence of long-term follow up. These findings contradict the results of 2 previous reviews [21,22] that suggested beneficial effects of biofeedback as compared with no intervention.

#### 4.2. Metabolic syndrome

Metabolic syndrome describes a cluster of 5 conditions (hypertension, hypertriglyceridemia, low HDL-cholesterol, visceral obesity, insulin resistance), is considered a major risk factor for cardiovascular morbidity and mortality. Moreover, its prevalence is growing with the increase in obesity, physical inactivity and unhealthy lifestyles. Insulin resistance is considered a central component, and both a proinflammatory state and activation of the sympathoadrenal system appear to be involved in the underlying pathogenesis. M. Paul-Labrador et al. [23] conducted a RCT of 84 patients with metabolic syndrome who were randomized to an intervention group that received training on transcendental meditation (TM) and a control group that received health education. They reported a significant improvement in fasting blood glucose and insulin levels in the TM group, with

no differences between groups in the levels of lipoproteins, high-sensitivity C-reactive protein, or body mass index.

In their study of 101 patients with metabolic syndrome, Khatri and colleagues [24] evaluated the efficacy of yoga combined with standard care versus standard care alone, observed a significant improvement in waist circumference, SPB and DBP, fasting blood glucose, HbA1C, serum triglycerides and serum HDL-cholesterol in the yoga + standard care group as compared with controls. By contrast, in their comparison of the effects of restorative yoga versus no intervention, Cohen et al. [25] found no differences between groups in fasting glucose levels, insulin sensitivity index, or levels of total cholesterol, LDL-C, HDL-C, or triglycerides.

Xin Liu and colleagues [26] conducted a RCT of 41 patients with high glucose levels (most of them where diabetic). Patients were assigned to an intervention group (conventional care plus weekly qigong training for 12 weeks) or a control group (standard care alone). They reported a significant positive effect in the intervention group on weight, waist circumference, leg strength, HbA1c, insulin resistance and fasting blood insulin.

Most of the aforementioned studies involved elderly patients. However, obesity and physical inactivity among young people is a growing problem in our society. Weigensberg and coworkers [27] evaluated the effects of guided imagery in a group of 29 obese adolescents, and observed significant beneficial effects, as evidenced by a decrease in sedentary leisure behavior and an increase in moderate physical activity and salivary cortisol levels. No significant changes in adiposity or insulin resistance were detected.

## 5. Cardiovascular disease

To the best of our knowledge, the most recent meta-analysis of the effects of mind-body therapies as a whole in the treatment of cardiovascular disease [28] was published in 2015. The authors found only 11 randomized controlled trials (RCTs), which included 793 patients (46% female) with a mean age 66 years ( $\pm$  11 years). The interventions used were MBSR, stress management, progressive muscle relaxation, relaxation response, transcendental meditation, and in one study, relaxation combined with cardiac rehabilitation. Control group interventions included waiting list, extra attention via telephone calls, health education, cardiac rehabilitation, and in one study, weekly talks on stress management. 5 studies included patients with heart failure, 4 with coronary artery disease and 2 included various diagnoses (angina, hypertension, valve disorders and coronary artery disease). Outcomes were classified subjectively and physiologically. Among subjective outcomes, the authors reported a medium significant effect size on quality of life (measured in 6 studies), depression (2 studies) and anxiety (5 studies). Among physiological, they reported a medium significant effect size for systolic blood pressure, a lower but still significant size effect for diastolic blood pressure, and an overall small effect on resting heart rate. Exercise tolerance was evaluated in 2 studies, which reported moderate  $VO_2$  max test and large 6-minute walk test effects. Overall, this meta-analysis shows promising results, but underscores the lack of good-quality studies in this field.

One randomized study of 748 patients undergoing coronary percutaneous intervention or elective catheterization [29] assigned patients to the following intervention groups prior to undergoing the procedure: Prayer assistance; music, imagery and touch (MIT) therapy; prayer + MIT; no intervention. None of the interventions were associated with an improved clinical outcome.

A recent meta-analysis of 35 RCTs examined the benefits of traditional Chinese exercises (including tai-chi and qigong) in 2249 patients with cardiovascular disease (ischemic heart disease, cerebrovascular disease, hypertension and other vascular diseases) [30]. The authors reported that traditional Chinese exercises were associated with decreases in systolic (9.1 mmHg) and diastolic (5.1 mmHg) blood pressure, but had no significant effects on heart rate or peak oxygen uptake. They reported significant improvements in levels of triglycerides, total cholesterol, LDL, HDL, B-type natriuretic peptide, an almost 60-m improvement in the 6-minute walk test, improved quality of life as determined by questionnaire.

Another meta-analysis [31] of 12 RCTs of adult patients (n = 1085) with diagnosed coronary heart disease examined the efficacy of a broad range of mind-body interventions, including stress reduction/relaxation training, nutrition counseling and exercise/sport. The primary outcomes analyzed were new cardiac events, overall mortality, cardiac mortality, and the secondary outcomes were atherosclerosis, systolic and diastolic blood pressure, LDL cholesterol, body mass index. The authors reported significant effects of mind-body interventions on cardiac events, atherosclerosis and SBP but not on mortality, DBP, LDL or BMI.

Schneider et al. [32] conducted a RCT of 201 black adults with angiographic coronary artery stenosis without previous infarction, stroke or revascularization. The intervention group participated in a transcendental meditation program and the control group in a cardiovascular health education program. The risk of mortality, myocardial infarction and stroke was significantly reduced in the intervention group, the effect was associated with decreases in blood pressure and psychosocial distress.

The effects of tai-chi on heart failure (n = 30 patients, median age = 64 years) were investigated in a RCT [33]. The inclusion criteria were a left ventricular ejection fraction of 40% or less and stable pharmacologic therapy for the previous 3 months. The exclusion criteria were unstable angina, myocardial infarction, uncontrolled arrhythmias or structural valvular disease. The intervention group was assigned to a 12-week tai-chi program in addition to standard care, while the control group received standard care alone. The intervention group showed significant improvements in quality of life scores and in the 6-minute walk test (135 meters), and a significant decrease in levels of B-type natriuretic peptide. This group also showed a trend towards improved peak oxygen uptake. No differences in catecholamine levels were observed between groups.

## 6. Conclusions

Mind-body therapies are a group of alternative therapies that focus on the relationship between mental and somatic processes. All have shown some degree of efficacy in reducing stress and improving the balance between sympathetic and parasympathetic systems. As such, these approaches may be of benefit for the management of cardiovascular diseases and risk factors, particularly given the absence of adverse effects and their proven beneficial effects on quality-of-life scores. Moreover, some of these techniques constitute gentle forms of exercise that could serve as useful surrogates for cardiac rehabilitation and conventional exercise. On the other hand, the broad diversity of the methods used and the lack of standardization significantly hinder accurate evaluation of the effects of mind-body therapies. While numerous studies have reported promising results, additional large, high-quality, well-designed randomized controlled trials will be required to better determine the therapeutic value of these approaches.

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