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Yoga and Cardiac Rehabilitation – A Brief Review of Evidence

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Introduction

Coronary heart disease (CHD) is a major form of cardiovascular disease (CVD) and is amongst the leading causes of morbidity and mortality worldwide despite notable advancements in drug therapy and revascularisation procedures. Although primary prevention remains a key aspect in limiting prevalence, especially given modern lifestyle and an increasingly ageing population, management and secondary prevention have become priority considerations for health providers involved with CHD. As such, the last decade has reflected this with an emphasis on the increasing importance of preventative and cardiac rehabilitation (CR) programs.

CR programs typically combine strength and aerobic exercises with patient education and stress management to improve risk factors, functional capacity, and to reduce mortality. Prior evidence highlights that such programs can reduce CHD mortality by 20% to 25% alongside their widespread acceptance and adoption into numerous national and professional management guidelines [1]. Despite this, numerous barriers including insufficient patient referral, adherence, convenience, motivation, and physical or psychological limitations may impede the transition of such benefits into clinical practice [2]. Statistics indicate that less than half of eligible patients enrol into available CR programs with 40% attendee attrition prior to completion [2].

Yoga is believed to originate 5000 years ago. The contemporary variants of yoga are heavily influenced by yogic sutras from 200 BCE that attempted to define and standardise yogic practice into 'eight limbs' or key facets including yamas (observance), niyamas (self-discipline), asana (physical postures), pranayama (breath regulation), pratyahara (sensory withdrawal), dharana (concentration), dhyana (mediation), and samadhi (integration) (Gard et al., 2014). Traditional yogic practices centred on the development and unification of both physical and spiritual aspects. Whilst this is reflected in the eight limbs and echoed in contemporary practice, modern yoga styles are predominately comprised of physical postures (asana), breathing exercises (pranayama), and meditation (dhyana) with the remaining eight limbs blended and interspersed amongst these three as opposed to being explicit component as once seen in traditional practices.

Preliminary evidence exists to support the use of yoga as a beneficial adjunctive intervention for CHD, which may also address a number of issues faced by secondary preventative programs. The popularity of yoga allows for easy accessibility whilst the social interaction and variety of yoga styles cater for a wide spectrum of cardiac patients in regards to their physical capacity and psychosocial mind-set [3]. In addition, the physiological and psychological therapeutic profile of yoga further emphasises its potential as an adjunctive cardiac rehabilitative intervention. In this review, a brief overview of the scientific evidence associated with yoga and it effectiveness for improving cardiovascular function in conjunction with the management of psychosocial components such as stress, anxiety, and depression in CHD populations is provided.

Yoga and Cardiovascular Function

Yoga has been shown to positively affect cardiovascular parameters across diverse spectrum of both healthy and pathological populations, but the underlying mechanisms have yet to be fully elucidated. Prevalent hypotheses in the literature (as demonstrated in Figure 1) suggest that yoga may elicit cardiovascular changes through neurological pathways such as the hypothalamic-pituitary adrenal (HPA) / sympatho-adrenal medullary (SAM) axes and the autonomic nervous system (ANS) as well as physical exercise mechanisms or through neural networks such as the Default Mode Network (DMN)[4]. Increased muscle activity and subsequent cardiovascular and respiratory improvements during postures (asana) and breathing (pranayama) of yoga is believed to be induced, in part, by increased nitric oxide level and antioxidant capacity in the blood vessels[4]. This alteration in endothelial function and arterial stiffness may explain the blood pressure lowering property of yoga. Furthermore, modulation of the HPA and the SAM may potentially reduce over-activation, over-production, and release of glucocorticoids, catecholamine, and subsequent pro-inflammatory cytokines which are considered as key contributors to increased CHD risk [5] Although there are a number of reviews and meta-analyses assessing the effects of yoga on cardiovascular function in high risk CVD population, healthy people, and other conditions [3,6,7] studies in the CHD cohort are limited. In most of the clinical studies of yoga and CVDs, the primary outcome measures assessed are typically modifiable CHD risk factors such as heart rate, blood pressure, lipid profiles, and Body Mass Index (BMI). Yoga has been shown to significantly reduce heart rate and blood pressure [5,8], improve lipid profile (e.g., total cholesterol, LDL, triglycerides) (Jatuporn et al., 2002, Sivasankaran et al., 2006) [8], and to reduce bodyfat and BMI [9] (Figure 1).

Sivasankaran et al. [8], Yadav et al.[10], and Pal et al. [9] evaluated non-traditional risk factors in CHD population such as brachial artery vasoreactivity, lung diffusion capacity, and heart rate variability (HRV). Brachial artery vasoreactivity data highlighted significant changes from baseline in CHD patients (68.9%) during endothelial dependent flow mediated dilation, however comparative analysis was not conducted and data was insufficient for a post-hoc analysis. There were also statistically significant improvements across numerous parameters of pulmonary

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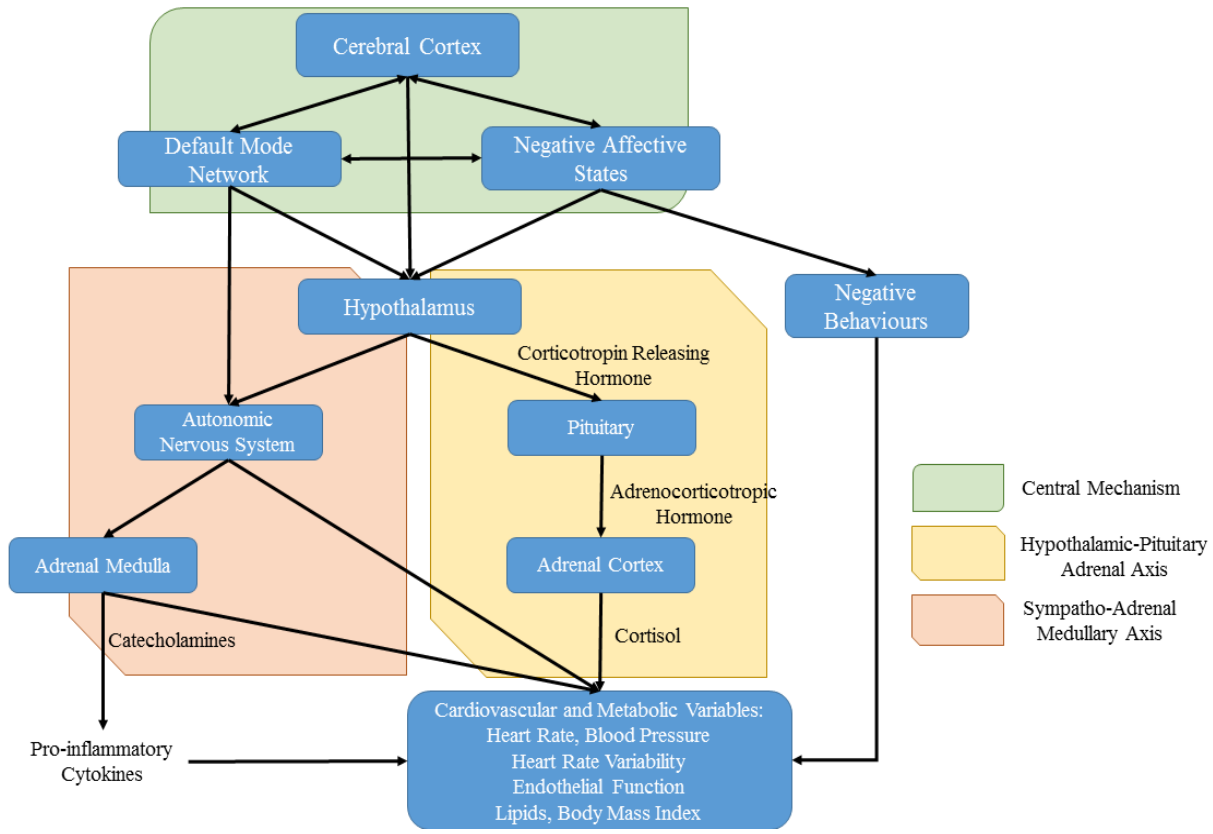

Figure 1: Potential central and neuroendocrine pathways affected by yogic practice.

function including slow vital capacity, forced vital capacity, forced expiratory volume, peak expiratory flow rate, maximum voluntary ventilation, and diffusion factor of lung carbon monoxide. In addition, beneficial effects of yoga have been demonstrated in total antioxidant status, NHHA functional class and angina episodes, ST segment depression and exercise duration. However, due to the variations in yogic style, dosage, and inclusion of complementing therapeutic factors such as diet, the interventions employed in CHD yoga trials are relatively heterogeneous. Whilst some studies provide details regarding postures and sequences employed, numerous trials assessing yoga in CHD do not specifically define the yoga style employed [3]. Furthermore, there were a lack of sufficient methodological rigour and risk of bias across the majority of CHD clinical trials to allow definitive conclusions to be drawn.

Stress, Anxiety, and Depression in CHD and Potential benefits of Yoga

Research trends over the past decade have increasingly shifted away from traditional linear and casual risk factors in CHD in favour of a more dynamically integrated model, incorporating both physiological and psychological components. In this regard, there has been a significant accumulation of evidence highlighting the interrelated effects of negative affective states such as stress, anxiety, and depression on CHD. Whilst these states are distinctly separate at a conceptual level, the prevalent paradigm views them as overlapping states existing on a continuum with anxiety, depression and stress sharing physiological components [7].

Whilst all three psychosocial affective states are associated with development and prognosis of CHD and CVD in general, depression remains at the fore in regards to research and interventional efforts. This is due to the plethora of evidence highlighting numerous putative mechanisms that are physiologically plausible, as well as a notably elevated prevalence in CHD populations. Evidence in the literature estimates depression rates at 15% to 30% in CHD populations in comparison to approximately 7% in the general population [5] Furthermore, several systematic reviews indicate depression as an independent risk factor can double the risk of mortality, increase risk of CHD incidences be 1.6 times, and negatively impact on CR adherence [5].

Although anxiety research focus in CHD is relatively obscure in comparison to depression, it has nonetheless been implicated as a prognostic risk factor for increased mortality [11]. The prevalence of anxiety is less consistent and robust than depression, however meta-analyses suggest that current rates of anxiety in CHD to be approximately 15% with various anxiety sub-types being 2%-3% higher than general population estimates [11]. Aditionally, anxiety and depression have a tendency to cluster within CHD with reported co-morbidity rates of up to 50% resulting in a substantial number of patients presenting with multiple psychological symptoms [11].

Stress, anxiety, and depression share a number of similar pathophysiological components. Although the precise physiological and biochemical mechanisms that underlie the bidirectional associations between these negative affective states and CHD have yet to be completely delineated, numerous hypothesises have been proposed in attempt to explain this phenomena including the HPA axis, SAM axis, autonomic dysregulation, inflammatory pathways, endothelial dysfunction, and negative associated behaviours.

The HPA axis is activated by corticotropin-releasing hormone from the paraventricular nucleus of the hypothalamus, prompting the release of corticotropin from the pituitary gland which then stimulates the production of glucocorticoids, in particular cortisol, from the adrenal cortex. Abnormal HPA axis function is believed to contribute to cardiovascular risk through modifications of risk factors including elevation of blood pressure and lipid levels, insulin resistance, and abdominal obesity [5]. The SAM axis involves systemic catecholamine release which has a notable impact on sympathetic heart function. Furthermore, catecholamines are strong stimulators of pro-inflammatory cytokines such as interleukin-6 which itself is a potent stimulator of the HPA axis and major cytokine inducer of C-reactive protein [5].

In addition, Behaviours in depression and anxiety can also negatively alter the course of CHD. Depression is associated with non-compliance to medications, reduced self-motivation, lack of smoking cessation, and physical inactivity further worsening cardiac outcomes; whereas anxiety can manifest with different behavioural patterns including less contact with their cardiologists, less likely to seek preventative medical care and poorer medication compliance [5,12].

Given the high rates of prevalence and comorbidity. it is unsurprising that routine screening for psychosocial disorders in CR programs are advocated in numerous professional guidelines [11]. However, CR programs themselves typically lack strong psychosocial intervention components due to a predominate focus on physical exercise. Whilst unidirectional feedback from physical exercise will benefit comorbid psychosocial states and trending results appear to support this in CR, current research is still inconsistent and unclear as to which components of CR programs facilitate this [12].

Prior systematic reviews on yoga for stress, anxiety, or depression are devoid of studies containing CHD populations and CHD focused yoga reviews provide little discussion on these risk factors [3,6,7]. Whilst there is a significant body of evidence to support the application of yoga in healthy, psychosocially affected, and various pathological populations, there are relatively few studies which examine these effects as primary outcome measures in CHD or CR populations.

One such study conducted by Yogendra et al. [13]. Demonstrated a trend towards psychosocial improvements in both anxiety and depression in CHD patients even though these results did not reach statistical significance. Improvements in anxiety scores were found in 90.3% and 95.8% of participants allocated to the yoga group in covert and overt anxiety, respectively. Similarly, a recent trial by Raghuram et al. [14] demonstrated within group benefits on the Perceived Stress Scale, both anxiety and depression subscales of the Hospital Anxiety Depression Scale, as well as on the negative component of the Positive and Negative Affect Scale. Yoga was also shown to significantly improve anxiety and depression in hypertensive patients.

Although positive results demonstrate potential benefits of yoga for depression and anxiety across diverse populations, methodological rigour and sample size remain as common concerns [1,7]. Furthermore, there is significant diversity in yogic styles employed, impeding replication. However it has been noted that Hatha and Iyengar were the most common styles in trials assessing stress and mood in various populations [7]. Additional clinical trials are required to determine yoga's efficacy in CHD and CVD populations.

Summary and Conclusion

There is a substantial amount of evidence highlighting the broad therapeutic profile of yoga across a spectrum of conditions including CHD. However the majority of studies lack methodological rigour and adequate reporting, thereby impeding replication and the ability to draw firm conclusions.

The variance in the degree of clinical benefit highlighted throughout these studies may hinge on utilisation of specific yoga forms and intensity of treatment over a defined period of time. While the fundamental components of yoga including specific stretching, breathing/relaxation exercises, and attention to body position and alignment are typically common elements, details regarding duration of individual components, included postures, degree of modification, and variations from generalised yoga styles are essential for discerning yoga-specific effects. The frequency, duration, and style of the yoga components further add to the variance between studies. Reporting of yogic styles was absent across numerous studies however prior reviews have indicated studies of Hatha and Iyengar yogic styles were the most predominate amongst significant range of styles including Sudarshan Kirya, Kundalini, Restorative, Silver, Ashtanga, Viniyoga, and Vinyasa yoga [15]. Whilst these two styles have been highlighted, there was little information related specific yogic styles in CHD [3].

Future studies should be encouraged to develop yoga programmes on the basis of current evidence in addition to adequate reporting; thereby creating new research that is more comparable in regards to intervention type, duration, intensity, class frequency and compliance that will allow for more definitive conclusions to be reached.

Furthermore, there is a growing need for neuroimaging focused studies to elucidate the neuropsychological component that is an integrative aspect of yogic practice. At present, the available information provides a relatively comprehensive representation of yoga from the perspective of the 'body' whilst the 'mind' is under-appreciated. The logistical and financial obstacles in administration however, may impair the production of high quality imaging trials.

Overall, a significant body of evidence across CVD, CHD and other populations highlights the potential to improve cardiovascular performance, and reduce of yoga stress, anxiety, and depression. Whilst there are numerous potential benefits of yoga, consideration of a collaborative care paradigm emphasising facilitated self-management through the employment of care managers may further augment patient satisfaction and compliance in addition to cardiovascular and psychosocial outcomes [16]. Neverthless, given the broad therapeutic profile and potential of yoga in CHD, its application may prove to be an invaluable adjunctive component to existing cardiac rehabilitative interventions.

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