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Physical Activity in the Prevention and Treatment of Coronary Heart Disease

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Abstract

Background: Coronary heart disease stands as a leading cause of death worldwide. **Purpose:** The purpose of this student driven, narrative review was to explore potential risk factors for coronary heart disease and the effects of physical activity on coronary heart disease prevention and treatment. **Methods:** Literature searches using relevant keywords were conducted through the University of British Columbia Library, PubMed, and Google Scholar. **Results:** There was strong evidence demonstrating that regular exercise is effective in mitigating risk factors for coronary heart disease and reducing the incidence of adverse events associated with coronary heart disease. Exercise is a fundamental aspect of cardiac rehabilitation prescribed to individuals with coronary heart disease following a myocardial infarction. **Conclusion:** There is the potential for future studies to investigate the effects of specific exercise prescriptions in the treatment of CHD. **Health & Fitness Journal of Canada 2019;12(4):66-71.**

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Keywords: Exercise, Fitness, Coronary Artery Disease, Cardiovascular Disease, Clinical Cardiac Rehabilitation, Cardiac Rehabilitation, Exercise Rehabilitation

Introduction

Coronary heart disease (CHD) refers to the narrowing of the coronary arteries, often due to a build-up of plaque in the arterial walls through a process called atherosclerosis (Parment, 2004). CHD remains a leading cause of death in developed countries, despite significant developments in medical interventions (Backshall et al., 2015). The Public Health Agency of Canada (2018) reported approximately 1 in 12 Canadian adults are diagnosed with CHD, with 578,000 individuals having a history of an acute myocardial infarction.

Advancements in clinical research have demonstrated strong evidence for the benefits of regular physical activity (PA) in CHD prevention and treatment. PA participation has been correlated with reduced CHD incidence and mortality in the general population (Backshall et al., 2015). Cardiac rehabilitation has also been identified as a potentially successful intervention to improve cardiorespiratory fitness and overall health in patients with CHD (Warburton et al., 2005).

Despite considerable evidence for the health-related benefits of routine PA (Warburton et al., 2006), a large proportion of the world's population

remains physically inactive (Lee et al., 2012). Physical inactivity can confer an attributable risk for death due to CHD comparable to that of other traditional modifiable risk factors (LaMonte et al., 2000). Hence, substantial evidence suggests an inverse relationship between PA and CHD, where greater levels of PA may confer reduced CHD risk (Warburton et al., 2006).

The purpose of this student driven, narrative literature review was to explore potential risk factors for CHD and the effects of PA on CHD prevention and treatment. It was hypothesized that there would be considerable evidence that supports the health-related benefits of PA in CHD prevention and treatment.

Methods

Separate literature searches were conducted through the University of British Columbia (UBC) Library, PubMed, and Google Scholar using the following keywords: physical activity, exercise, coronary heart disease, coronary artery disease, cardiovascular (CV) disease, clinical cardiac rehabilitation. Titles and abstracts of studies were screened prior to reviewing each paper. Identified studies specifically investigating the benefit of PA on CHD prevention and treatment were further reviewed.

Results

The following topics of interests were identified through full text review of 30 studies, published from 1980 to 2019: CHD causes, risk factors, prevention, and treatment.

CHD is primarily caused through atherosclerosis, where coronary arteries become narrow due to plaque accumulation, thereby reducing blood flow to the heart (Gander et al., 2014).

Lack of oxygen-rich blood leads to ischemia of myocardial tissues and consequent heart dysfunction (Gander et al., 2014).

Major modifiable risks factors of CHD include obesity, hypercholesterolemia, hypertension, diabetes, smoking, and physical inactivity (Hajar, 2017). Hajar et al. (2017) showed cholesterol levels were inversely related to CHD incidence, where elevated cholesterol levels were associated with increased CHD risk. Correspondingly, a 1% decrease in cholesterol levels can result in a 2% decrease in risk of CHD adverse events (Clark, 1986). Escobar (2002) observed that the presence of hypertension increases the risk of mortality with CHD and emphasize that treatment of hypertension can significantly reduce risk of mortality in CV events. Smoking has been linked to CHD risk via blood coagulation due to enhanced platelet function, but this is still viewed as speculative and further research is needed to fully elucidate the relationship between smoking and CHD according to Stallones (2014). Greater platelet function is related to thrombogenesis, which may lead to myocardial infarction (Inoue, 2004).

The positive relationship between PA and attenuated CHD risk has been well established in the current literature. For example, Sesso et al. (2000) observed a statistically significant CHD risk decrease in middle-aged men of about 20% with 30 minutes of PA on most days of the week. Similarly, Wen et al. (2011) found individuals who performed 15 minutes of moderate-intensity exercise above recommended values of 150 minutes induced reductions in all-cause mortality by 4%. Moreover, the largest benefits were observed within the first 2 hours of

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exercise per week, indicating that even low volumes of exercise can be beneficial (Wen et al., 2011).

Several studies have also investigated the influence of PA on CHD-specific risk factors. Kimata, Willcox, and Rodriguez (2018) reported type 1 and type 2 diabetic individuals who walked 1.5 miles per day saw reduced CHD risk to levels similar to an aged-matched healthy control group. Furthermore, Swift et al. (2013) reported regular PA and maintenance of cardiorespiratory fitness reduces prevalence of CHD-specific risk factors such as obesity, dyslipidemia, and inflammation.

PA based health benefits are attributed to various exercise-related biological mechanisms. Kraus et al. (2002) noted high-intensity aerobic exercise elicited a substantial increase in HDL and decreases in LDL cholesterol levels. Furthermore, in individuals with high PA levels and energy expenditure (i.e., 2200kcal/week), plaque lesion levels have been shown to decrease, reducing the risk for CHD (Hambrecht et al., 1993). In addition, combined resistance and aerobic training is suggested to improve glucose metabolism, resulting in reduced body fat and improvements in muscular strength and cardiorespiratory fitness (Bacchi et al., 2012). Aerobic exercise is reported to reduce both systolic and diastolic blood pressure by 2.6-3.8 mmHg (Swift et al., 2013).

PA has also been shown to improve psychological health in individuals with CHD (Artham, Lavie, & Milani, 2008). Compared to the general population, individuals with CHD have a larger prevalence of depressive symptoms (Thombs et al., 2006). Investigating treatment options is vital to improve both depressive symptoms and overall quality

of life; poor psychological indices scores are positively correlated with poor outcomes after CHD-related events (Leung et al., 2012). For example, CHD patients with high psychological distress who received cardiac exercise rehabilitation demonstrated significantly improved post-intervention scores for depression, anxiety, and overall quality of life, compared to individuals who did not receive the intervention (Artham, Lavie, & Milani, 2008).

PA in the form of cardiac rehabilitation has been widely supported within the literature in improving the prognosis of patients with stable CHD. For example, CHD patients who participated in PA saw a reduced risk of CV and all-cause mortality compared to those who were sedentary (Anderson et al., 2016; Biscaglia et al., 2019). Exercise rehabilitation has positive effects on aerobic capacity, which can be an independent predictor of CV and all-cause mortality (Franklin, Swain, & Shephard, 2003).

Biscaglia et al. (2019) described an inverse relationship between exercise frequency and intensity, and risk of adverse clinical outcomes. Namely, vigorous PA once or twice a week was found to confer an optimal reduction in CV and all-cause mortality (Biscaglia et al., 2019). Cardiac exercise rehabilitation in the form of both aerobic interval and continuous training were found to be equally efficacious in improving aerobic capacity, peripheral endothelial function, and other CV risk factors (Conraads et al., 2015).

Although aerobic PA is the cornerstone of cardiac rehabilitation, many CHD patients experience muscular atrophy (Theodorou et al., 2016). Thus, it is clinically relevant for resistance training

to be required to induce muscular hypertrophy Franklin et al. (2003) recommend a minimum of two full-body resistance training sessions per week to be included in cardiac exercise rehabilitation programs. Increased muscular strength and endurance seen with resistance training can reduce the cardiac demands of everyday activities (Franklin et al., 2003).

Discussion

The current body of research suggests PA can be a viable option for preventing CHD. Growing evidence supports the potential of lifestyle change (i.e., increasing PA) as a clinical tool in the treatment CHD, because of the wide range of effects PA has on cardiovascular health.

It is important to note that much of the current research on CHD prevention and treatment focuses on a limited population, mainly consisting of middle-aged men from urbanized, developed countries. Future research should incorporate participants from diverse populations (i.e., sex, ethnicity, age, socioeconomic status) to increase generalizability. The high prevalence of physical inactivity and associated risk of CHD warrants further research focused on overcoming barriers to PA and implementing behavioral change into clinical practice.

Conclusions

CHD is the leading cause of death world-wide. The implementation of PA and lifestyle change can effectively reduce risk of CHD. Various exercise programs have been noted to have an effect on CHD incidence and severity, but currently, there is no consensus in the literature for an optimal exercise program. Further research is needed to elucidate the effects

of specific exercise prescriptions in the treatment of CHD. It is critical to utilize evidence-based research to reiterate the effectiveness of PA for reducing CHD incidence and improving overall health and well-being.

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Authors' Qualifications

The authors' qualifications are as follows: Ahmad A. Khadhair BKin (C), Laura A. Mar BKin (C), Kassandra A. Welch BKin (C), Azim Ahmed BKin (C), Christopher Tong BKin (C), Jacky Chen BKin (C).

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