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Cardiovascular benefits of exercise

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Abstract: Regular physical activity during leisure time has been shown to be associated with better health outcomes. The American Heart Association, the Centers for Disease Control and Prevention and the American College of Sports Medicine all recommend regular physical activity of moderate intensity for the prevention and complementary treatment of several diseases. The therapeutic role of exercise in maintaining good health and treating diseases is not new. The benefits of physical activity date back to Susruta, a 600 BC physician in India, who prescribed exercise to patients. Hippocrates (460–377 BC) wrote “in order to remain healthy, the entire day should be devoted exclusively to ways and means of increasing one’s strength and staying healthy, and the best way to do so is through physical exercise.” Plato (427–347 BC) referred to medicine as a sister art to physical exercise while the noted ancient Greek physician Galen (129–217 AD) penned several essays on aerobic fitness and strengthening muscles. This article briefly reviews the beneficial effects of physical activity on cardiovascular diseases.

Keywords: exercise, cardiovascular disease, lifestyle changes, physical activity, good health

Introduction

Cardiovascular disease (CVD) is the leading cause of death for both men and women in the United States. According to the American Heart Association (AHA), by the year 2030, the prevalence of cardiovascular disease is expected to increase by 9.9%, and the prevalence of heart failure and stroke are expected to increase by approximately 25%. It is estimated that this will raise the total direct cost for healthcare to \$818 billion and the total indirect cost due to lost productivity to \$275 billion.¹ On the other side of the Atlantic, one in five Europeans die because of coronary heart disease before the age of 75.² However, the burden of cardiovascular disease is not limited to developed countries anymore. In 2005, of the 58 million deaths that occurred worldwide, almost 30% were due to CVD.³ This is three times more deaths than are caused by all infectious diseases including HIV/AIDS, tuberculosis, and malaria combined.^{4,5} Nearly 80% of these CVD-related deaths occur in lower middle income countries, and one half of these deaths occur in women. It is projected that CVD will be responsible for 25 million deaths worldwide in 2020. CVD has truly become a global epidemic.⁶

Discussion

CVD is a largely preventable condition. Although several risk factors for CVD are non-modifiable (age, male gender, race, and family history), many others are amenable to intervention. These include elevated blood pressure, abnormal blood sugar, high cholesterol, smoking, obesity, a high fat and high calorie diet and excess stress.

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The AHA recommends that blood pressure be kept under 140/90, fasting blood sugar be less than 110 mg/dL, low-density lipoprotein cholesterol stay below 100 mg/dL, smoking be stopped, a body mass index of less than 25 kg/m² be maintained, and a heart healthy diet be eaten. Moderate alcohol intake (less than two drinks per day), and aspirin taken in low doses among high risk groups are also recommended for their cardiovascular benefits. Another modifiable behavior with major therapeutic implications is inactivity. The cardiovascular effects of leisure time physical activity are compelling.^{7,8} The AHA recommends that all Americans invest in at least 30 minutes a day of physical activity on most days of the week, given its substantial health benefits; however, most healthy adults remain sedentary and fail to get an adequate amount of physical activity.⁹

Inactivity or a sedentary lifestyle is associated with increased cardiovascular events and premature death.¹⁰ Sedentary behavior, measured by television viewing time, has been associated with adverse cardiovascular health, increased obesity, diabetes mellitus, cancer, and early death.¹¹ A review of several studies has confirmed that prolonged total sedentary time (measured objectively via accelerometer) has a deleterious relationship with cardiovascular risk factors, disease, and mortality outcomes.¹²

On the other hand, health benefits of adequate physical activities like walking, swimming, cycling, or stair climbing are well documented. Regular exercise has been shown to reduce type 2 diabetes,^{13,14} some cancers,^{15,16} falls,¹⁷ osteoporotic fractures,¹⁸ and depression.¹⁹ Improvements in physical function^{20–22} and weight management^{23–26} have also been shown. There is also an increase in cognitive function,^{27,28} enhancement of the quality of life,²⁹ and decrease in mortality.^{30,31}

Several occupational studies have shown adequate physical activity also provides extensive cardiovascular benefits.^{32–37} Chair bound double-decker bus drivers in London have more coronary heart disease than mobile conductors working on the same buses.³⁸ Postal workers delivering mail by foot similarly have lower incidence of coronary disease than their office based colleagues.³⁹ Railroad workers and longshoremen have reduced incidence of coronary heart disease compared to those in less active occupations.^{40,41}

Well conducted long term studies have also documented the cardiovascular beneficial effects of regular exercise. Leisure time exercise reduced cardiovascular mortality during a 16 year follow up of men with high risk of coronary heart disease in the MRFIT study.⁴² In the Honolulu Heart Study, elderly men walking more than 1.5 miles per day

similarly reduced their risk of coronary disease.⁴³ Walking was associated with cardio-protection in the Nurses' Health Study,⁴⁴ and moderate activity in post-menopausal women was similarly associated with a reduced risk of coronary disease in the Iowa Study.⁴ People engaging in regular exercise have also demonstrated other CVD benefits such as decreased rate of strokes and improvement in erectile dysfunction. There is also a 3-year increase in lifespan in these groups.⁴⁶

Regular physical activity helps reduce several cardiovascular risk factors including obesity,^{47,48} dyslipidemia,^{49,50} hypertension,^{51,52} metabolic syndrome,⁵³ and diabetes mellitus.^{54,55} Among patients with established coronary disease, regular physical activity has also been found to help improve angina-free activity,⁵⁶ prevent heart attacks,⁵⁷ and result in decreased death rates.⁵⁸ In patients with heart failure, exercise improves heart function and quality of life.^{59,60} It also improves walking distance in patients with peripheral artery disease.⁶¹ Supervised exercise programs such as cardiac rehabilitation in patients who have undergone percutaneous coronary interventions, heart valve surgery, have stable chronic heart failure, are transplantation candidates or recipients, or have peripheral arterial disease result in significant short and long term CVD benefits.^{62–64}

In 1995, the Centers for Disease Control and the American College of Sports Medicine recommended that all Americans try to engage in at least 30 minutes of moderate intensity physical activity on most or preferably all days of the week.⁶⁵ Therapeutic activity should incorporate a range of motion exercises, resistance training, as well as an aerobic workout. Aerobic exercise improves cardio-respiratory fitness and favorably modulates several CVD risk factors. Leisure related aerobic activities such as walking, hiking, and gardening are generally more enjoyable, making them more conducive for long term adherence.⁶⁶ Mild to moderate resistance training may be achieved by weight lifting, weight bearing calisthenics, or other resistance exercises involving the major muscle groups. They recommend that 8–10 exercises be performed on two non-consecutive days of the week, with 8–12 repetitions of each exercise terminated by volitional fatigue. These provide an effective method for improving muscular strength and endurance, attenuating the rate-pressure product and improving coronary risk factors.^{67,68} Range of motion and stretching exercises such as yoga reduce sympathetic activity and improve several other cardiovascular risk parameters. Together, they have salutary cardiovascular effects. Since data indicates that cardiovascular disease begins early in life, physical interventions such as regular exercise should be started early for maximal effect.^{69–72}

It is critical that lifelong health promoting behaviors, such as physical exercise, be introduced to youngsters. The US Department of Health and Human Services for young people recommends that school students achieve a target of 60 minutes of daily exercise.⁷³ This may be achieved via a mandated curriculum involving moderate to vigorous activity during 50% of the physical education class time. Transition from high school to college is associated with a steep decline in physical activity. In addition to renovating outdated facilities, universities can help by developing mandatory health curricula teaching fitness based courses. Provision of convenient and adequate exercise time as well as free or inexpensive college credits for documented work-out periods can further enhance compliance. Time spent on leisure time physical activity decreases further with entry into the workforce. Free health club memberships and paid supervised exercise time could help promote a continuing exercise regimen. Government sponsored subsidies to employers incorporating such exercise programs can help decrease the anticipated future cardiovascular disease burden in this population.

General physicians can play an important role in counseling patients and promoting exercise.^{74,75} Although barriers such as lack of time, inadequate or no reimbursement of physicians, and patient non-compliance exist,⁷⁶ medical reviews support the effectiveness of physician counseling, both in the short term^{77,78} and long term.⁷⁹ The good news is that the percentage of adults advised to exercise by physicians in the United States has increased from 22.6% in 2000 to 32.4% in 2010.⁸⁰ Physician empowerment, with training sessions and adequate reimbursement for their services, and patient tailored interventions with written materials, reminders, and follow up visits will further increase this percentage.⁸¹ We expect that this should also greatly enhance patient compliance and ensure long term adherence.

Conclusion

Sedentary lifestyle is an important cardiovascular risk factor. CVD has no geographic, socioeconomic, or gender boundaries. It is the leading cause of death in developing and developed countries. Risk factors for CVD are consistent throughout the world, and this includes lack of physical activity. Although the benefits of leisure time physical activity for reducing CVD are irrefutable, only one in three Americans meets the minimal recommendations for activity as outlined by the Centers for Disease Control, the American College of Sports Medicine, and the AHA. Physical activity is an easy, inexpensive, and effective way to avoid CVD, and the

benefits accrue, irrespective of the age at which a person initiates an exercise program. Reduced CVD burden as a result of regular exercise will not only improve the quality of life, but will increase the lifespan for millions of humans worldwide. There will also be an economic benefit to all the countries in the world with a saving of billions of health related dollars.

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