

PHYSICAL ACTIVITY AND CARDIOVASCULAR HEALTH

ÁGUEDA COTIGNOLA, ANDREA ODZAK, JORGE FRANCHELLA, ALAND BISSO, MARITZA DURAN, RODOLFO PALENCIA VIZCARRA, RICARDO GÓMEZ HUELGAS, WESLEY RODRÍGUEZ

Current state of knowledge

Physical activity (PA) is defined as any body movement produced by the contraction of skeletal muscles that increases caloric requirements with respect to rest¹. PA, in general terms, includes any movement that enhances energy expenditure; in contrast, exercise is a more specific form of physical activity that is structured and designed to improve physical fitness².

PA plays an increasingly significant role in the prevention and treatment of multiple chronic diseases, health issues, and their associated risk factors³. It is considered an essential component of cardiovascular health, along with a healthy diet, nicotine cessation, and maintaining healthy sleep, weight, blood pressure, and serum glucose and lipid levels⁴.

Numerous epidemiological studies document the inverse relationship between PA and the incidence of cardiovascular diseases (CVD), CVD-related deaths and all-cause mortality^{2,3,5,6}. Higher levels of PA or cardiorespiratory fitness provide additional health benefits⁷. Approximately one-third of the global population is estimated to be physically inactive, a condition that increases with age, is more prevalent in women, and in countries with higher incomes⁸.

The following effects are some of the cardiovascular health benefits of PA^{2,3,9-11}:

1) Cardiovascular and respiratory function

- Decrease in heart rate and blood pressure, reduction in myocardial oxygen consumption, and decrease minute ventilation.

- Increase in maximum oxygen consumption.

- Increase in the exercise threshold for the accumulation of lactate in the blood.

- Increase in the exercise threshold for the appearance of signs or symptoms of disease (e.g., angina, ischemic ST segment depression, peripheral arterial claudication).

- Improvement of endothelial function through increased nitric oxide, reduction of oxidative stress, increased circulating endothelial progenitor cells, inhibition of proinflammatory cytokines, and increased expression of various regulators of endothelial function¹².

2) Risk factors for CVD

- Reduction of resting systolic and diastolic blood pressure.

- Increase in high-density lipoproteins and decrease in blood triglycerides.

- Reduction in total body fat and visceral fat.

- Reduction in insulin requirements, improvement in glucose tolerance, and reduction of inflammatory markers.

3) Reduction in morbidity and mortality

- Primary prevention: Higher levels of activity or physical fitness are associated with lower rates of death from coronary heart disease and lower incidence of CVD, coronary artery disease, ictus, type 2 diabetes mellitus, and metabolic syndrome.

- Secondary prevention: Cardiovascular and overall mortality are reduced in patients with acute myocardial infarction (AMI) who participate in cardiac rehabilitation exercises.

Muscular strength training improves cardiometabolic risk given the benefits in body composition, glycemic profile, insulin sensitivity, dyslipidemia, and blood pressure^{2,13-17}, which is associated with fewer non-fatal cardiovascular events¹³ and lower mortality risk from all causes. In adults with type 2 diabetes mellitus, the combination of aerobic and strength training achieves better glycemic control and reduction in cardiovascular events¹⁸.

PA in the elderly reduces the risk of CVD, improves glucose tolerance and bone mineral density, reduces inflammation and oxidative stress, improves mitochondrial biogenesis and protein synthesis in skeletal muscle. Even engaging in regular leisure activities provides cardiovascular benefits in frail older adults; however, moderate to vigorous aerobic activities have a more significant reduction in mortality¹⁹.

Sarcopenic obesity is a global health phenomenon due to the aging population combined with the obesity epidemic. The loss of muscle mass, associated with the increase in adipose tissue, leads to a vicious cycle that promotes an unfavorable metabolic state, with increased insulin resistance, pro-inflammatory cytokines, increased oxidative stress and mitochondrial dysfunction, all of which increases the risk of atherosclerosis and cerebrovascular

disease. Hence, the importance of promoting physical activity programs in older adults²⁰.

Risks

In general, the benefits of regular PA far outweigh the risks^{2,11,21}. However, participation in PA or exercise is associated with an increased risk of musculoskeletal injuries (MSIs)²² and potential cardiovascular complications¹³. The latter are much less common than MSIs but can lead to long-term morbidity and mortality²¹.

Adverse cardiovascular events, such as sudden cardiac death (SCD) and AMI, are generally associated with vigorous exercise in individuals with pathological cardiovascular conditions^{23,24}.

In athletes and young individuals, the most common causes are congenital and hereditary disorders (mainly hypertrophic cardiomyopathy, anomalies of the coronary arteries, and aortic stenosis)²¹. The incidence of SCD in young athletes varies among studies but is estimated to be up to 2 per 100,000 athletes per year²⁵.

In adults, exercise-related SCD is more often attributed to acute complications of atherosclerosis^{21,26} (over 80% in those older than 35 years and 95% in those older than 40 years)²⁷⁻³⁰. There is an acute and transient increase in the risk of SCD and AMI in individuals who are usually inactive, diagnosed, or hidden CVD, and engage in infrequent or unusually intense exercise^{23,31,32}. Even though the risk increases with age^{21,23}, it decreases with the long-term adherence to a gradually increasing regular exercise regimen (cardiovascular rehabilitation programs)^{21,33}.

Recommendations

- Adults should move more and sit less during the day. For sedentary individuals, PA of any intensity can provide health benefits, even after a single session of less than 10 minutes².

- Promoting active transportation has health benefits³⁴ and can significantly increase physical activity levels at the population level^{35,36}. Community-based interventions are effective in improving PA levels among residents, with more pronounced effects in the first two years. Therefore, it is important to sustain these interventions over time and institutionalize them within cardiovascular disease control and prevention programs, particularly in low- and middle-income countries where they have proven to be cost-effective³⁷.

- For substantial health benefits, adults should engage in at least 150-300 minutes per week of moderate-intensity exercise, or 75-150 minutes per week of vigorous-intensity aerobic exercise, or an equivalent combination, preferably distributed (in different sessions) throughout the week.

- Additional health benefits are obtained by engaging in PA beyond the equivalent of 300 min of moderate-intensity PA per week.

- Adults should also perform muscle-strengthening activities that involve all major muscle groups at least twice a week.

- As a strategy to reduce adverse cardiovascular events during exercise²¹, everyone should participate in pre-exercise assessment to help identify individuals at risk^{33,38} and determine the need for medical clearance. Additionally, physically active individuals should modify their exercise program in response to variations in their exercise capacity, usual activity level, and environment. They should be aware of prodromal cardiac symptoms (e.g., excessive and unusual fatigue and chest or upper back pain) and seek immediate medical attention if they occur.

- While there was evidence until a few years ago that aerobic exercises had greater benefits than resistance exercises in overweight, hypertensive, dyslipidemic, and hyperglycemic patients³⁹, recent years have shown that insulin sensitivity in adults with overweight or obesity, insulin resistance, prediabetes, or diabetes improves with any modality of exercise. However, intensive interval training often results in more MSIs than moderate training⁴⁰. The combination of aerobic exercise with strength and muscle resistance training had the greatest reduction in disease and death⁴¹.

- There is evidence that exercise improves glycemic control, reduces cardiovascular risk factors, contributes to weight loss, and enhances the well-being of diabetic patients. Diabetic patients should engage in 150 minutes of aerobic activities per week, distributed over at least 3 days. Baseline PA and sedentary time should be evaluated to promote non-sedentary activities such as walking, yoga, household chores, gardening, swimming, and dancing⁴².

Conclusion

There is strong evidence that regular PA is necessary for improving cardiovascular health. PA reduces all-cause mortality, improves cardiorespiratory and metabolic health, promotes weight loss, enhances muscle health, and improves sleep quality. However, there is a risk of cardiovascular complications in individuals with CVD engaging in unusual vigorous efforts. Therefore, it is recommended to undergo a pre-participation assessment accordingly and gradually increase the volume of PA.

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