

BENEFITS OF EXERCISE IN THE ELDERLY



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Abstract

Exercise is well known to have various health benefits in the elderly. This article explores the potential benefits of exercise on optimizing cardiovascular physiology, preventing falls, and improving cognitive function. Aging is associated with a stiffening of vasculature and decrease in ventricular compliance. Both aerobic and resistance training have been shown to benefit cardiovascular health through the modification of traditional risk factors as well as improving the exercise capacity of the heart. Exercise programs have been shown to prevent falls, although no single type of exercise or training program stands out alone as being effective. In older adults with mild cognitive impairment or dementia, aerobic and resistance training have been associated with improvement in cognitive function. Exercise may also provide improvements in other domains, such as mental health and social engagement. The frail elderly may be limited in their capabilities to perform certain exercise programs; however, they may still derive benefit from modifications that focus more on improvement in daily function and strength.

Résumé

Les bénéfices de l'exercice physique sur plusieurs aspects de la santé des personnes âgées sont bien connus. Cet article revoit les effets bénéfiques possibles de l'exercice : optimisation de la physiologie cardiovasculaire, prévention des chutes et amélioration des fonctions cognitives. Le vieillissement est associé à une rigidité des vaisseaux sanguins et à une diminution de la compliance ventriculaire. L'entraînement aérobique et les exercices de résistance ont démontré des bénéfices sur la santé cardiovasculaire, via le contrôle des facteurs de risque traditionnels et l'amélioration de la capacité cardiaque. De plus, les programmes d'exercice semblent diminuer le risque de chutes, quoiqu'aucun type d'exercice ou de programme en particulier ne se démarque en termes d'efficacité. Chez les personnes âgées avec troubles cognitifs légers ou démence, les exercices aérobiques et de résistance ont été associés à une amélioration des fonctions cognitives. Également, l'exercice peut apporter des effets positifs dans d'autres domaines, comme la santé mentale et l'engagement social. La personne âgée frêle peut être limitée dans sa capacité à participer à certains programmes d'exercice. Néanmoins, la personne frêle peut toujours profiter des bénéfices d'exercices adaptés qui ciblent davantage l'amélioration de la force musculaire et de l'autonomie fonctionnelle.

Exercise is well known to have many health benefits. The American guidelines recommend at least 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous-intensity aerobic activity per week, or a combination of the above, where 1 vigorous minute is equivalent to 2 moderate-intensity minutes.¹ The Canadian guidelines only specify 150 minutes of moderate-vigorous intensity aerobic activity. Adults should engage in muscle-strengthening activities of moderate or high

intensity involving all major muscle groups 2 days of each week.²

This article explores some of the specific benefits related to common issues pertinent to the geriatric population. As exercise is modifiable according to specific abilities, it has the potential to have widespread impact.

Exercise and the Cardiovascular System

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The aging process affects the cardiovascular system in many ways.

In the heart:

- myocyte loss with increase in fibroblasts and collagen deposition

In the vasculature:

- arterial walls become stiff and thickened due to collagen deposition, elastin loss, and hypertrophy of the smooth muscle cells
- endothelial dysfunction, decreased NO mediated relaxation

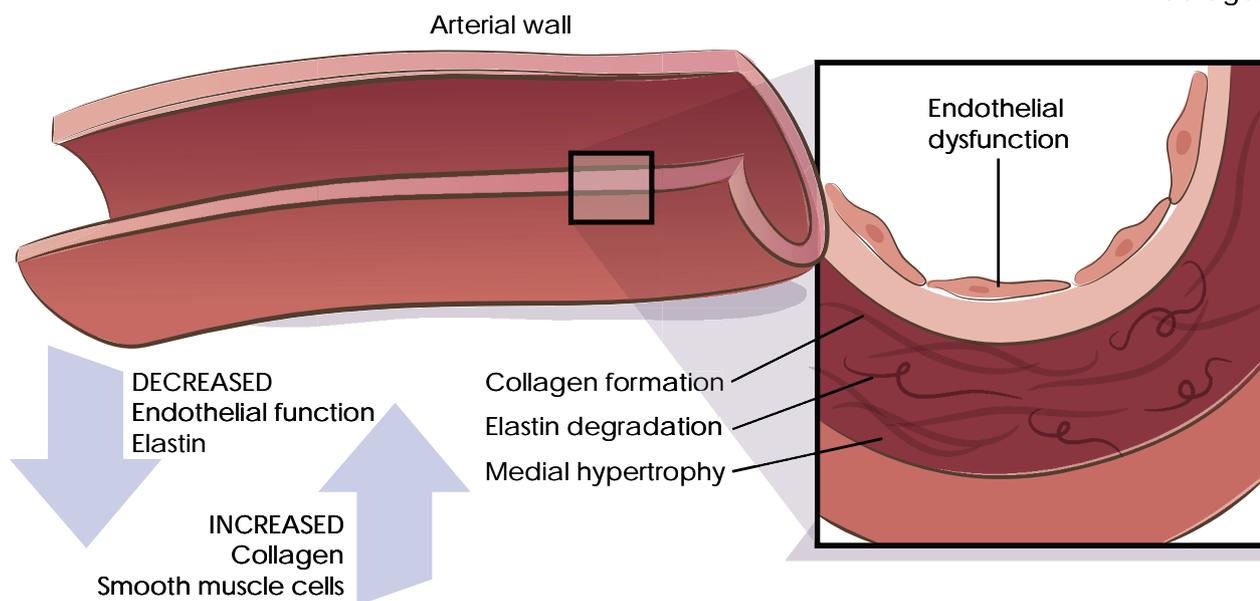
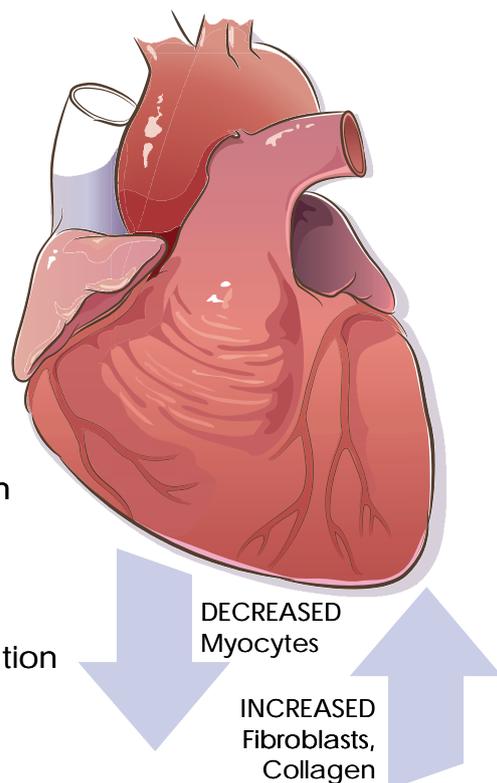


Figure 1. Exercise and the cardiovascular system.

system in a number of ways (Figure 1). In the vasculature, arterial walls become stiff and thickened due to collagen deposition, elastin loss, and hypertrophy of the smooth muscle cells.³ In addition, there is endothelial dysfunction caused by mechanisms such as a decrease in nitric oxide-mediated relaxation.³ In the heart, there is myocyte loss with an increase in fibroblasts and collagen deposition, resulting in decreased ventricular compliance.³ It is known that aging decreases exercise capacity and the cardiac responses to exercise.³ However, both aerobic and resistance training have been shown to be beneficial to cardiovascular health.

A recent study illustrates the potential effects of aerobic exercise on cardiac function as measured on echocardiography. Sixteen healthy seniors were compared with 11 senior master athletes and 10 sedentary young adults.⁴ The group of healthy seniors was subjected to 12 weeks of aerobic interval training (AIT) at 90% submaximal heart rate three times per week.⁴ It was found that AIT was able to improve age-related diastolic function at rest and left ventricular diastolic and systolic exercise reserve.⁴ In addition, lifelong exercise results in an increase of left ventricular volumes and diastolic reserve capacity compared with those of young sedentary people.⁴ Although this study has its limitations, its findings are provocative. Resistance training has been shown in previous studies to improve blood pressure, dyslipidemia, and glycemic control, as well as increasing muscle mass.⁵

Exercise and Falls

The elderly are at a higher risk of falls, with the potential for consequences that can significantly affect their functional abilities and independence. Known risk factors for falls include lower extremity weakness, previous falls, gait and balance disorders, visual impairment, depression, functional and cognitive impairment, dizziness, low body mass index, urinary incontinence, orthostatic hypotension, female sex and being over age 80, polypharmacy (i.e., taking over four prescription medications), and the use of psychotropic medications.⁶ Exercise can play an important role in reducing the risk of falls. A recent meta-analysis showed that exercise reduced the rate of falls by 16%.⁷ Several conclusions were drawn from this analysis that provide useful guidance. Exercise programs should challenge balance through reducing the base of support, movement of the centre of gravity, and reducing the need for upper limb support.⁷ However, exercise needs to be undertaken for a sufficient dose and be ongoing to have continued effects.⁷ Strength training is not essential but does increase muscle mass, reducing one of the risk factors.⁷ There have been a number of different programs studied. An updated Cochrane Review concluded that both multi-component group and home-based exercise programs are effective.⁸ Tai chi has also been shown to reduce the risk of falling, possibly through balance training.⁸ One meta-analysis suggested that the programs that have the greatest effect on preventing falls are those that involve balance training and are done for more than 2 hours a week over a 6-month period.⁹ Given the number of contributors to falls, multifactorial interventions have also been tried with some success.⁸

Given that falls are often an end result of a compilation of many

factors, it is not surprising that there is no single type of exercise or training program that stands out alone as being effective. However, the available evidence is encouraging, and it should be looked at as another one of many beneficial effects of exercise for general health and well-being.

Exercise and Cognition

As of 2011, about 15% of Canadians older than the age of 65 are living with cognitive impairment, a decline of cognitive function that is more than expected for normal aging but does not meet the criteria for dementia.¹⁰ It is projected that by 2038, one new case of dementia will be diagnosed every 2 minutes.¹¹ Given its prevalence, any effective intervention for prevention or treatment has the potential to make a great impact on health care costs and quality of life for many.

Exercise has been associated with improvements in cognitive function in older patients both with and without dementia or mild cognitive impairment (MCI). A meta-analysis involving 29 randomized controlled trials of healthy adults without dementia found that aerobic exercise improved memory, attention, processing speed, and executive function.¹² However, aerobic exercise alone did not appear to improve working memory¹² (memory that allows for temporary storage and manipulation of information in order to process the information for higher-level cognitive function¹³).

Another large meta-analysis of 30 randomized trials of mostly aerobic exercise involving 2,020 subjects with dementia or mild cognitive impairment showed that exercise improves fitness, physical function, and cognitive function.¹⁴ Possible explanations for these observations have been postulated. Exercise may increase the expression of genes and factors that are responsible for neuroplasticity.¹⁵ For example, important growth factors, such as brain-derived neurotrophic factor (BDNF) and insulin-like growth factor 1 (IGF-1), have been found to

Key Points

- *Both aerobic and resistance training have been shown to benefit cardiovascular health through the modification of traditional risk factors as well as improving the exercise capacity of the heart.*
- *Although there are many effective exercise programs for preventing falls, there is currently no single type of exercise or training program that stands out alone as being more effective.*
- *Exercise has been associated with improvements in cognitive function and may also provide benefits in other domains, such as mental health and social engagement.*
- *For the elderly who are limited in their physical capabilities, a focus should be made on improving strength and function rather than improving cardiopulmonary fitness.*
- *Canadian guidelines recommend 150 minutes per week of moderate-intensity aerobic activity, with muscle-strengthening activities of moderate or high intensity involving all major muscle groups 2 days of each week.*

be lower in patients with Alzheimer's disease.¹⁵ Most of the research into the benefits of exercise on cognition has focused on aerobic exercise. However, there has also been work recently that suggests similar benefits with resistance training.

Besides the localized effects that exercise has on the brain, exercise also reduces the incidence of cardiovascular risk factors, which may be important in preventing vascular dementia. Although exercise has been shown to be associated with improved cognition, it is difficult to determine the benefits of exercise independent of its association with improving cerebrovascular risk factors, increasing social engagement, or improvement in mental health at this time. However, these are all important components of aging well.

Older Adults with Activity Limitation

The elderly may be limited in their exercise capacity due to co-morbid illnesses, such as cardiac, neurological, and musculoskeletal diseases, and may not be able to meet the weekly recommendations of moderate- to vigorous-intensity exercise. Although they may not be able to derive primary or secondary prevention benefits, exercise can still benefit the frail elderly.¹⁶ Strength training exercises are often easier to perform than aerobic exercise, and advantages can be demonstrated more in terms of improvement in daily function and strength.¹⁶ In addition, recent studies show that sedentary behaviour is an independent cardiovascular risk factor.^{17,18} Therefore, any kind of activity, regardless of the intensity, may be beneficial for frail older persons. Ultimately, it is important to adjust exercise programs to accommodate each person's limitations so that maximum benefits can be derived without causing any injuries.

Summary

Exercise is an important component of maintaining health. In the elderly population, exercise improves cardiovascular physiology and health, prevents falls, and has been associated with improved cognitive function. However, the elderly are often physically limited by co-morbidities that prevent them from reaching the recommended intensities or duration of exercise. In these circumstances, focus should be made on improving strength and function rather than improving cardiopulmonary fitness. Exercise programs should be customized to suit what the individual can do.

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