



ISSN: 2456-4419

Impact Factor: (RJIF): 5.18

Yoga 2018; 3(2): 1073-1076

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[www.theyogicjournal.com](http://www.theyogicjournal.com)

Received: 06-07-2018

Accepted: 12-08-2018

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## The athlete and sudden death

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### Abstract

Regular exercise is a cornerstone of health and wellness for individuals across all age groups, offering profound benefits for physical and psychological well-being. This study emphasizes the importance of a consistent physical activity regimen, particularly aerobic exercise, in enhancing exercise capacity and reducing cardiovascular morbidity and mortality. Among older adults, the tendency toward physical inactivity contributes significantly to declines in functional capacity, many of which are preventable through regular exercise. The findings highlight that the benefits of physical activity in elderly individuals are comparable to those observed in younger populations, including improved exercise tolerance, psychological health, and reduced cardiovascular and all-cause mortality rates. Moreover, regular physical activity not only increases life expectancy but also enhances the quality of life, ensuring healthier and more fulfilling years. These insights underscore the critical role of physical activity in promoting longevity and vitality, irrespective of age.

**Keywords:** Exercise, physical activity, cardiovascular health, elderly, functional capacity, life expectancy, quality of life

### Introduction

Engaging in consistent physical exercise is highly beneficial for individuals of all age groups, and adopting a structured physical activity regimen is universally recommended for adults. Regular aerobic exercise has been scientifically proven to enhance physical capacity and play a crucial role in both the prevention and management of cardiovascular diseases. Its benefits extend to reducing morbidity and mortality associated with cardiovascular conditions. However, as individuals grow older, a notable decline in physical activity levels often occurs, contributing significantly to a decrease in functional abilities. This decline, commonly linked to sedentary lifestyles, can be mitigated or even prevented through regular physical activity.

The advantages of consistent exercise are not restricted to younger populations; older and elderly individuals also experience significant health improvements. These benefits include enhanced exercise tolerance, better psychological health, reduced risk of cardiovascular diseases, and a lower overall mortality rate. Furthermore, regular exercise contributes to an increase in life expectancy and significantly improves the quality of life during the years a person lives. For elderly individuals, the impact of physical activity extends beyond physical health, promoting better mental clarity, reduced risks of depression, and a stronger sense of independence.

The physiological and psychological benefits of exercise are underpinned by several mechanisms. Aerobic activities, such as walking, cycling, or swimming, enhance cardiovascular efficiency by improving oxygen delivery to tissues and optimizing heart function. This, in turn, reduces the risk of developing chronic conditions such as hypertension, type 2 diabetes, and obesity. Moreover, resistance training improves muscle strength, bone density, and joint flexibility, all of which are critical for maintaining mobility and preventing falls in older adults. Psychologically, exercise triggers the release of endorphins, often referred to as "feel-good" hormones, which reduce stress and anxiety while enhancing overall mental well-being. Regular physical activity has been shown to positively influence cognitive function, delay the onset of dementia, and improve memory retention, making it indispensable for aging populations.

Cardiovascular health remains a primary concern for adults, particularly as they age. Regular physical activity reduces the risk of coronary

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artery disease by lowering LDL (bad cholesterol) levels, increasing HDL (good cholesterol) levels, and maintaining healthy blood pressure. It also enhances the body's ability to regulate blood sugar, reducing the likelihood of diabetes, which is a significant risk factor for cardiovascular complications. The anti-inflammatory effects of exercise further contribute to vascular health, decreasing the likelihood of arterial blockages.

One of the most profound impacts of regular exercise is its ability to enhance the quality of life. For older adults, this includes maintaining independence, reducing the need for medical interventions, and improving social interaction through group activities. Exercise also delays the onset of age-related conditions like osteoporosis and sarcopenia, which can severely impair mobility and quality of life. Furthermore, engaging in regular physical activities fosters a routine, providing a sense of purpose and achievement that is particularly valuable in combating feelings of isolation and loneliness in older individuals.

Globally, public health initiatives are increasingly emphasizing the importance of physical activity for aging populations. Campaigns promoting accessible exercise programs, community fitness centers, and awareness about the risks of sedentary lifestyles aim to encourage individuals to integrate exercise into their daily lives. Technological advancements, such as wearable fitness trackers, are also helping individuals monitor their activity levels and stay motivated to achieve their fitness goals.

Regular exercise is a cornerstone of a healthy lifestyle that benefits individuals of all ages, particularly older adults. By enhancing physical and mental health, reducing the risk of chronic diseases, and improving overall quality of life, exercise serves as a powerful tool for healthy aging. Encouraging lifelong physical activity and fostering an environment where exercise is accessible and enjoyable can significantly contribute to a healthier, more active population, regardless of age.

### Physiological changes associated with aging

Aging is associated with progressive changes and increased in cardiovascular, respiratory, musculoskeletal and central nervous system functions that impact on functional capacity and the types of exercises that individuals can perform. These changes are due to physical inactivity and disease.

### Phases of growth and aging

Growth and aging can be divided into three phases:-

- Phase I is the phase of growth and development
- Phase II is the maturity phase
- Phase III is the aging phase

### Fitness, endurance and aging

Fitness and endurance are crucial components of a healthy lifestyle that enable individuals to perform physical activities efficiently and sustain these abilities across the lifespan. The ability to engage in physical tasks without undue fatigue is a hallmark of physical fitness, while endurance reflects the capacity to maintain these activities over extended periods. As individuals age, preserving these abilities becomes increasingly important for maintaining quality of life and overall health.

### The Role of VO2 Max in Fitness and Endurance

Maximum oxygen consumption, commonly referred to as VO2 max, is a widely accepted measure of cardiopulmonary

endurance. VO2 max reflects the maximum amount of oxygen an individual can utilize during intense exercise and is considered a key marker of both fitness and clinical health status. Higher VO2 max levels indicate superior cardiovascular and respiratory efficiency, allowing individuals to perform sustained physical activities with greater ease.

### Fitness across the Lifespan

Fitness and endurance are dynamic traits that tend to decline with age, primarily due to reduced physical activity and natural physiological changes. However, regular physical activity can significantly mitigate this decline. Adults who engage in aerobic exercises, such as running, cycling, or swimming, tend to maintain higher VO2 max levels compared to their sedentary counterparts. Resistance training also plays a vital role by preserving muscle mass, bone density, and joint flexibility, which collectively contribute to functional fitness and mobility.

### Aging and Its Impact on Cardiopulmonary Endurance

As individuals age, VO2 max typically decreases at an average rate of 1% per year after the age of 25. This decline is associated with reduced cardiac output, decreased muscle mass, and diminished lung capacity. However, regular exercise can slow this decline significantly, allowing older adults to maintain higher levels of fitness and endurance than those who lead inactive lifestyles. Furthermore, improved VO2 max levels in older adults are linked to better cardiovascular health, lower risks of chronic diseases, and enhanced overall well-being.

### Benefits of Sustained Fitness and Endurance

**Cardiovascular Health:** Regular physical activity enhances heart health by improving blood circulation, lowering blood pressure, and reducing the risk of atherosclerosis.

- Mental Well-being:** Endurance activities stimulate the release of endorphins, reducing stress, anxiety, and depression.
- Improved Mobility:** Maintaining fitness helps prevent falls and injuries by preserving strength, balance, and coordination.
- Increased Longevity:** Higher VO2 max levels are associated with reduced mortality rates and improved life expectancy.
- Quality of Life:** Sustained endurance enables older adults to engage in daily activities and hobbies, fostering independence and self-confidence.

### Strategies to Maintain Fitness and Endurance with Aging

- **Aerobic Exercise:** Incorporate activities like brisk walking, jogging, swimming, or cycling to boost cardiovascular health and VO2 max.
- **Resistance Training:** Engage in strength training exercises to maintain muscle mass and bone density.
- **Flexibility and Balance:** Practice yoga, tai chi, or similar activities to enhance flexibility and prevent falls.
- **Consistency:** Adopt a routine that includes moderate-intensity physical activity for at least 150 minutes per week, as recommended by health guidelines.
- **Nutrition and Hydration:** Support physical activity with a balanced diet rich in proteins, vitamins, and minerals, along with adequate water intake.

Fitness and endurance are vital for sustaining a healthy and active lifestyle, particularly as individuals' age. VO2 max

serves as a key indicator of an individual's cardiopulmonary fitness and overall health status. By engaging in regular physical activity and adopting a comprehensive fitness regimen, individuals can enhance their endurance, reduce the risks of age-related health issues, and improve their quality of life. Promoting lifelong fitness should remain a priority for both individuals and public health initiatives to foster healthier, more active communities.

#### **Aerobic capacity and maximum oxygen consumption**

The decline in function that accompanies aging is primarily a consequence of age related decrements in cardiovascular, pulmonary, and musculoskeletal function. Physical activity individuals and athletes have higher baseline VO<sub>2</sub>max values and less decreasing aging.

**Cardiac output peripheral vascular resistance and blood pressure:** Maximum attainable heart rate declines with age, as do stroke volume, cardiac output, and the magnitude of increase in arterial pressure during exercise. Decreased left ventricular compliance, impaired diastolic filling, decreased cardiac contractility and impaired chronotropic response to exercise contributes to the reduction in cardiac output. Systolic pressure is increased in aorta and arteries. There is a modest decline in peripheral oxygen extraction with aging.

#### **Muscular strength and flexibility**

Muscular strength decreases with aging and correlates with a decrease in muscle mass and force. Muscle mass begins to decline at about age 30 years and muscular strength may decrease 30-50% with aging.

#### **Training and age related decrease in exercise capacity**

Exercise training can delay and partially reverse some of the age associated decline in cardiac function capacity. Low intensity aerobic training can elicit an increase in VO<sub>2</sub>max, a finding that is of particular importance for developing exercise programmed for the elder and others who cannot or who choose not to, engage in various physical activities.

#### **Highly trained individuals and elite athletes**

In cross sectional and longitudinal studies of the older elite athlete, it has been shown that the decrease in VO<sub>2</sub>max with aging can be blunted by approximately one half with continued hard training. Highly trained older and elderly individuals can maintain stroke volume, peripheral oxygen extraction and body composition at or near the levels they possessed in their 20s and 30s there were no differences across age between fit and unfit on maximum heart rate, excess CO<sub>2</sub> and respiratory exchange ratios. The sharpest decline in most variables occurred after age 50 years.

**Exercise patterns in older males and females physical activity levels:** It's not uncommon to see individuals of all ages engaging in recreational, low intensity exercise (e.g. brisk walking, doubles tennis, bicycling in vigorous aerobic exercises such as jogging or singles tennis. Among those adults aged 65 years and older who choose to exercise, walking, gardening and yard work are the most common forms of physical activity.

#### **Factors influencing choice of activity among the elder**

Women and older adults (older than 50 years) report significantly more walking as physical activity than younger respondents. Respondents who were more involved in sports

and exposed to physical education classes in childhood were less likely to walk for exercise, but more likely to choose vigorous exercises for fitness. Age was the most powerful demographic variable that correlated with walking for fitness.

#### **Competitive athletics in older individuals**

As long distance running the most common form of vigorous exercise in this group (older athletes 35 years and older). Some patients who were long distance runners before their infarction may return to this activity if their cardiac status permits.

#### **Benefits of exercise in older adults**

Healthy men and women as well as many of those with cardiovascular disease derive benefit from regular physical activity. These benefits include improved exercise capacity, primary and secondary prevention of cardiovascular disease, and lower cardiovascular and overall mortality rate.

#### **Physiological benefits**

The specific physiological benefits of regular exercise in older individuals include improvements in physical performance and functional capacity, maximal exercise capacity, and oxygen consumption, and cardiac output; a decline in resting heart rate and blood pressure; and increased cardiovascular fitness. These improvements are due to peripheral and cardiac adaptation, but in other individuals and in patient with heart or lung disease, peripheral adaptations are especially important.

#### **Psychological benefits**

The psychological benefits of regular exercise include feeling better, looking better, having more energy, improved memory etc. improved levels of self-esteem reported in physically active persons may largely due to improved personal appearance and self-image.

#### **Patients with cardiovascular disease**

In patients with known coronary heart disease, exercise has similar benefits as in individuals without cardiovascular disease. These include improvements in exercise tolerance muscle strength, and endurance; decrease in blood pressure. It's because of coronary artery disease.

#### **Guidelines for exercise prescription for older and elderly adults**

- Goals of exercise training and rehabilitation
- Frequency, Duration, Intensity
- Type of activity
- Aerobic activities include brisk walking, cycling etc.
- Low intensity activities include doubles tennis, yoga, dance etc.

In designing exercise program for older and elderly individuals, it is important to give consideration to their special need.

Older patients require longer warm up and cool-down periods.

**Exercise guidelines for patients with coronary heart disease: Cardiac rehabilitation:** Rehabilitation of cardiac patients includes comprehensive, long term program involving prescribed exercise, cardiac risk factor modification. It divided into four phases:

- Phase I is the inpatient program beginning as soon after the cardiac event or surgery as possible and when patient is stable.

- A Phase II is the immediate outpatient program it is hospital based, community based or home based with continues ECG monitoring.
- Phase III is the intermediate outpatient phase for low risk patients and can be home or community based with no ECG monitoring.
- Phase IV is the maintenance phase can be home or community based with no ECG monitoring.

#### **Exercise in patients with acquired valvular heart disease**

The prevalence of acquired valvular heart disease increases with age. The diagnosis can usually made on physical examination alone, and the severity can be estimated from the patient history, physical examination and noninvasive laboratory studies.

a) Mitral Stenosis: It is virtually always rheumatic in origin. Patients with severe mitral stenosis are usually symptomatic and do not attempt to participate in vigorous exercise and athletic activities.

b) Mitral Regurgitation

c) Aortic stenosis

Aortic stenosis may be rheumatic, congenital, or a result of calcify or degenerate changes. The severity of aortic stenosis can usually be determined by clinical and noninvasive laboratory evaluations. Severe aortic stenosis may produce left ventricular failure, syncope or angina. Sudden death is rare in patients with mild aortic stenosis, it may be occur completely asymptomatic individuals.

a) Aortic regurgitation It may be due to rheumatic heart disease, congenital bicuspid aortic valve infective endocardities and aortic root diseases.

#### **Special considerations for co-existing medical disorders**

Older and elderly patients often have co-existing medical disorders that may effect exercise capacity, including hypertension, peripheral vascular disease, diabetes and obesity.

a) Hypertension: Exercise may reduce the risk of hypertension and regular physical exercise usually results in lowered baseline blood.

b) Peripheral vascular disease: it includes low level aerobic activities.

c) Diabetes:-exercise should be done with a partner

d) Obesity: regular exercise improves caloric balance and helps in preventing obesity.

#### **Special considerations regarding exercise and medications**

a) Nitrates: It's frequently used in patients with coronary heart disease. It relax vascular smooth muscle

b) Beta blockers: It may reduce exercise tolerance and increases exercise capacity of heart patients.

c) Calcium channel blockers: It increases exercise capacity of heart patients. It 'decreases the heart rate and B.P. at rest and during exercise.

d) Diuretics: It's used in patients with cardiovascular disease, particularly hypertension

e) Vasodilators: It increases the heart rate and decreases blood pressure

#### **Special considerations in women**

a) Strength training: Progressive strength training is beneficial in men and women. Improved strength, flexibility and energy result from strength training.

b) Weight loss: It may become a serious problem because if left uncorrected, it can contribute to a number of

problems including disordered eating, iron deficiency anemia, and injuries.

- c) Anemia: Women are at greater risk of iron deficiency and resultant anemia than men. Women with anemia may have decreased oxygen. Carrying capacity because of the lower consideration of hemoglobin and lower blood volumes, lower iron strokes and increased absorption.

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