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Physical Activity in Ageing

Körperliche Aktivität im Alter

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ZUSAMMENFASSUNG

Bei Älteren verstärkt die körperliche Inaktivität den altersbezogenen Rückgang der körperlichen Funktionen, was Gebrechlichkeit und eine beeinträchtigte Lebensqualität verursacht und zu vermehrten Aufnahmen in Pflegeheimen führt. Wissenschaftliche Belege zeigen, dass regelmäßige körperliche Bewegung umfangreiche Gesundheitsvorteile mit sich bringt: Bei Älteren, wie auch bei jüngeren Personen ist eine regelmäßige körperliche Bewegung mit einem geringeren Risiko für verschiedene chronische Gesundheitszustände verbunden, einschließlich bestimmter Arten kardiovaskulärer und muskuloskeletaler Krankheiten (Sarkopenie und Osteoporose) und bestimmter Krebsformen (Brustkrebs, Darmkrebs). Regelmäßige körperliche Bewegung kann auch zu einer verbesserten mentalen und psychosozialen Gesundheit führen, wie beispielsweise bei depressivem Gemütszustand und schlechter Lebensqualität. Angesichts der Fülle wissenschaftlicher Beweise sollte körperliche Bewegung zu einer der höchsten Prioritäten in der Prävention und Rehabilitation von Krankheiten und Behinderungen bei älteren Menschen gehören. Obwohl jedoch aktuelle Empfehlungen, Bewegung an den meisten oder an allen Tagen der Woche unterstützen, geben nur 31 Prozent der 65- bis 74-Jährigen regelmäßig durchgeführte moderate körperliche Bewegung über 20 Minuten oder mehr an drei Tagen der Woche an. Da viele akute positive Effekte von Bewegung bei nachlassendem Training innerhalb von wenigen Wochen verschwunden sind, ist es wichtig, dass ältere Menschen ermutigt werden, sich selbstständig moderat zu bewegen. Dies ist besser einzuhalten als ein kurzzeitiges intensives und genau überwachtes Training.

Schlüsselwörter: Krafttraining, Ausdauertraining, kardiorespiratorische Fitness, Leistungsfähigkeit der Muskeln.

SUMMARY

In older adults, physical inactivity exacerbates the age-related decline in physical function, which causes frailty, impairs quality of life, and results in increases in nursing home admissions. Scientific evidence demonstrate that regular physical activity provides substantial health benefits: in older adults, as in younger individuals, regular physical activity is associated with a reduced risk of various chronic health conditions, including certain types of cardiovascular and musculoskeletal disease (sarcopenia and osteoporosis) and certain forms of cancer (breast, colon). Regular physical activity is also associated with many aspects of better mental and psychosocial health such as a depressive mood state and a poor quality of life. Given the breadth and strength of the evidence, physical activity should be one of the highest priorities for preventing and treating disease and disablement in older adults. However, although current recommendations encourage activity on most or all days of the week, only 31 percent of persons 65 to 74 years of age report regularly engaging in moderate physical activity for 20 minutes or more three days a week. Given that many of the acute benefits are lost within a few weeks of ceasing exercise, it is important that elderly people are encouraged to engage in modest levels of voluntary physical activity that they are likely to maintain, rather than focus on a short-term regimen of intensive and closely supervised training.

Key Words: Resistance, training-endurance, training-cardiorespiratory, fitness, muscle fitness.

INTRODUCTION

The proportion of Europeans aged 65 years and older will double by 2030. This, along with the high rates of poor physical health and activity limitations among the older individuals, will contribute to a projected 25% increase in the nation's overall health care costs during this time.

Regular physical exercise is an important element in overall Health promotion both during childhood and adulthood (7,19). The purpose of this review is to determine if regular physical activity contributes substantially to healthy aging by helping to prevent or control many of the health problems that often reduce the quality

and length of life in older individuals (eg, low fitness, hypertension, obesity, and diabetes mellitus)? In other words, is PA an effective strategy to improve quality of life, to prolong independent life expectancy, and reduce economic cost and social burdens in elderlies? Because, in addition to the expected positive effects of PA in mortality (increased life expectancy) and morbidity, what is more im-

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portant to elderly persons and clinicians is to determine if PA can prevent and/or reduce functional impairment (difficulty performing activities of daily living such as standing from a chair) and ultimately physical disability.

PHYSICAL ACTIVITY AND MORTALITY IN OLDER ADULTS

The first scientific evidence is that PA has a direct effect on health and survival in elderly persons. This is evidenced by association between physical fitness/cardiorespiratory fitness (CRF) and mortality (12, 13, 18). The term CRF refers to maximal aerobic capacity or maximal oxygen uptake (VO_2max) but is also assimilated with the terms of physical fitness or exercise capacity. VO_2max can be measured directly by gas exchange measurements during maximal exercise or indirectly by determination of the work performed at the time of exhaustion. It is expressed in peak METs (one MET is defined as the energy expended at rest, which is equivalent to an oxygen consumption of 3.5 mL per kilogram of body weight per minute).

In addition to aerobic capacity, CRF defines the ability of the respiratory, circulatory, and muscular system to supply oxygen during sustained physical activity and therefore represents the integrated functioning of numerous physiological systems. It depends on non-modifiable factors such as genetics (for 40 to 50% (1)) but mainly on modifiable factors and is primarily determined by PA. CRF is a sensitive and reliable measure of PA, a reproducible measure that reflects recent PA habits (but also disease and genetics) (2, 8). In contrast, it should be remembered that when PA level is measured with questionnaires, people tend to overreport their PA level. Self-reported PA, using questionnaires, only modestly correlates with objective measures obtained using criterion methods. Therefore, to overcome the shortcomings of self-reported PA, large epidemiological studies have used objective exposures to PA such as CRF (12, 13, 18).

Large epidemiological studies in apparently healthy subjects and in subjects with chronic diseases have reported an inverse, graded, independent and robust association between fitness status and mortality (2, 8, 12, 16, 18). This association between exercise capacity and mortality remains in older individuals as demonstrated by the study of Kokkinos et al. (13) where exercise capacity was assessed during a maximal exercise test in a cohort of 5000 subjects aged 65 to 92 years (median age, 75 years). Subjects were classified into two groups: half (3679) had an abnormal exercise-test result or a history of cardiovascular disease, or both, and 2534 had a normal exercise-test result and no history of cardiovascular disease. Overall mortality was the end point and the authors assessed the association between fitness and mortality 8 years later.

Their findings support an inverse, graded, and independent association between impaired exercise capacity and all-cause mortality risk. Significant reductions in mortality risk are evident beyond the fitness level represented by an exercise capacity of 5 METs. Compared with the lowest fitness category (5 METs) mortality risk declined significantly of 40% for those who achieved 5.1 to 6 METs and of 60% for those who achieved 9 METs. For every 1-MET increase in exercise capacity, the mortality risk was 12% lower for the entire cohort and for the two age categories (65-70 and >70 years).

Collectively, these findings suggest that an exercise capacity of 5 METs may be necessary for significant health benefits for those aged 65 years and confirm previous reports in broader age populations (16, 18).

Further evidence against reverse causality is provided by the association between changes in exercise capacity over time and mortality risk in individuals with repeat exercise test (13). Compared with unfit individuals in both tests (unfit-to-unfit), mortality risk was 61% lower in those who were physically fit in both tests (fit-to-fit). Individuals who were unfit during the initial test but became fit by the second test (unfit-to-fit) had a 35% lower mortality risk compared with subjects who were unfit at both examinations. This finding suggests that advancing from a low-fit to a fit status yields significant health benefits even at an advanced age.

In summary, this study is in accordance with previous studies, demonstrating that significant reductions in mortality risk are evident beyond the fitness level represented by an exercise capacity of 5 METs. This level of fitness is likely achievable by most older individuals through 20 to 40 minutes of moderate daily exercise such as brisk walking (13, 19). From an exercise intensity set at 40-50% VO_2max , cardiorespiratory fitness can be increased either by increasing the volume and/or the intensity of the exercise (13, 19). It remains to determine what is moderate daily exercise in older adults. Following the classification of the American College of Cardiology/American Heart Association (ACC/AHA) (19), « moderate-intensity aerobic activity involves a moderate level of effort relative to an individual's aerobic fitness. On a 10-point scale, where sitting is 0 and all-out effort is 10, moderate-intensity activity is a 5 or 6 and produces noticeable increases in heart rate and breathing. On the same scale, vigorous-intensity activity is a 7 or 8 and produces large increases in heart rate and breathing. For example, given the heterogeneity of fitness levels in older adults, for some older adults a moderate-intensity walk is a slow walk, and for others it is a brisk walk. This recommended amount of aerobic activity is in addition to routine activities of daily living of light intensity (e.g., self care, cooking, casual walking or shopping) or moderate-intensity activities lasting less than 10 min in duration (e.g., walking around home or office, walking from the parking lot). »

Collectively, these results support the concept that exercise capacity should be given as much attention by clinicians as other major risk factors. Moreover, physicians and other health care professionals should encourage older individuals to initiate and maintain a physically active lifestyle consisting of moderate-intensity activities (brisk walking or similar activities) at any age. Such programs are likely to improve exercise capacity and lower the risk of mortality in older adults.

PHYSICAL ACTIVITY ENHANCES COGNITIVE FUNCTION IN OLDER ADULTS

Strong evidence from longitudinal studies and randomized trials suggests that physical exercise enhances cognitive function in older adults (for a review see (23)).

Colcombe and Kramer conducted a meta-analysis of 18 randomized intervention studies that included both a control group and a training group (3). They showed that aerobic fitness training has a robust and beneficial influence on the cognition of sedentary older adults, increasing performance (0.5 SD on average), regardless of the type of cognitive task (with the largest fitness-induced benefits occurring for executive-control processes), the training method, or participants' characteristics.

Neuroimaging evidence supports this beneficial association between aerobic training in older adults and improved brain function and

structures showing, for example, an increase in brain areas involved in process important for task performance after a six-month aerobic training program in sedentary elders (4).

These improvements in cognitive function were obtained in cognitively intact subjects. PA also improves cognitive function in older adults with subjective and objective mild cognitive impairments. Finally, epidemiological and prospective studies largely supports the role of PA and aerobic fitness in preventing and/or delaying the onset of all types of dementia (14,23).

All these beneficial effects of PA on health related outcomes are due to regular endurance PA, which is associated with CRF. There are growing evidence that resistance training in seniors have positive impacts on health outcome and that it may do so in a manner that have previously been ascribed to aerobic exercise in seniors.

RESISTANCE TRAINING IN SENIORS

Normal aging is associated with a reduction in skeletal muscle mass and strength, which can ultimately lead to sarcopenia and functional impairment (difficulty performing activities of daily living such as standing from a chair)(15).

It is well known that physically active older persons, particularly those who perform regular resistance exercise, have larger muscles than their sedentary counterparts (11). Furthermore, it is well documented that strength training can increase skeletal muscle mass and strength in previously sedentary elderly men and women. For resistance exercise, it is recommended that 8-10 exercises be performed on two or more nonconsecutive days per week using the major muscle groups. Experts recommend 10 to 15 repetitions per set for older adults, at moderate intensity (5 or 6 on a 10-point scale) with 1 or 2 sets (19). To maximize strength development, a resistance (weight) should be used that allows 10-15 repetitions for each exercise (19).

Janssen and Ross summarized the two randomized and seven nonrandomized trials that have examined the effects of strength training per se on skeletal muscle, as measured by imaging modalities, in older persons (9). These studies ranged in duration from 8 to 16 weeks, and with the exception of one of the randomized trials, all noted a significant increase in skeletal muscle. From these studies it can be estimated (i.e., average of the group means obtained from all 9 studies) that skeletal muscle size increases by 1.0% for every week of resistance training performed in previously sedentary elderly persons. When combined with the observation that skeletal muscle mass decreases by 6% per decade, this suggests that 6 weeks of resistance exercise can reverse a decade's worth of skeletal muscle wasting (9). Thus, strength exercise can have a dramatic influence on sarcopenia. A recently published meta-analysis (20) and a Cochrane review article (17) also confirmed that resistance training two to three times a week can improve physical function and functional limitations and can reduce disability and muscle weakness in older people. Previous studies have demonstrated that resistance training in elderly people produces 9% to 15% increases in strength and approximately 5% in thigh muscle volume (20). However, a limitation of these studies is that many studies have shown that resistance training in elderly people must be conducted at high intensities and volumes to see improvements. In contrast, less-intense strength exercise programs have produced little or no strength gains (17,20). New reports using the combination of amino-

acid supplementation (AAS) and low intensity strength training are very promising. In the study of Kim et al. (10), one hundred fifty five women aged 75 and older were defined as sarcopenic and randomly assigned to one of four groups: exercise and amino acid supplementation (exercise+AAS), exercise, amino acid supplementation (AAS), or health education (HE). The exercise group attended a 60-minute comprehensive training program twice a week (moderate intensity strength exercise), and the AAS group ingested 3g of a leucine-rich essential amino acid mixture twice a day for 3 months. The data in this study show improvements of 2.4% in leg muscle mass, 2.0% in appendicular muscle mass, and 4.3% in leg strength in the exercise group. The moderate-intensity exercise provided in this trial produced strength gains that were smaller than those seen in previous studies, but the combination of moderate intensity exercise and AAS increased muscle mass 3.1% and muscle strength 9.3%, gains that are comparable with those observed in previous studies of high intensity exercise

EFFECTS OF PHYSICAL ACTIVITY ON OTHER CLINICALLY SIGNIFICANT OUTCOMES

Previous research have shown that lower extremity strength, aerobic endurance and flexibility are associated with increased falls, injuries from falls and may predict future dependence for activities of daily living. On the other hand, in older adults with poor mobility, consistent evidence demonstrates that regular PA is safe and reduces risk of falls by 30% (due to increased strength and balance) (6,20,21). Evidence is lacking for a beneficial effect of PA for elders who are not at risks of falls and this issue needs to be tested in future studies.

Finally, compared to less active individuals, men and women who are more active have higher level of CRF and muscle fitness, lower rates of all-cause mortality (cardiovascular and cancer), lower rates of morbidity (cardiovascular diseases, type 2 diabetes, colon and breast cancer) and healthier body weight and composition (including bone) (24).

PHYSICAL ACTIVITY IN OLDER PEOPLE : FEW MEET HEALTH RECOMMENDATIONS OF PA

Despite this increased knowledge concerning the relationship between PA and health we have become an increasing inactive society. The first evidence is that physical activity levels decline as people age (22), depriving their skeletal muscle of its primary environmental stimulus. Using objective measures of PA obtained with accelerometers in the NHANES survey, it was shown that PA decreased dramatically across age group between childhood and adolescence and continue to decline with age with less than 15 min per day of total PA in persons of age 65 years old and above (22). Although current recommendations encourage activity on most or all days of the week, only 31 percent of persons 65 to 74 years report regularly engaging in moderate physical activity for 20 minutes or more three days a week; this rate drops to 20 percent by 75 years of age. It has been estimated only less 5% of elderly (60+ years) are active in terms of meeting the recommended 30 minutes a day (5,24).

Interestingly, in a large prospective study of 416175 aged 20 years or older, including a group of subjects above 60 years, the minimum amount of PA for reduced mortality and extended life ex-

pectancy has been identified to be 15 min a day (25). Compared to inactive subjects, those who exercised 15 min a day had a reduced all-cause mortality by 14%. Every additional 15 min of daily exercise beyond the minimum amount of 15 min a day further reduced all-cause mortality by 4% (95% CI 2.5–7.0) and all-cancer mortality by 1% (0.3–4.5). These benefits were applicable to all age groups and both sexes, and to those with cardiovascular disease risks. These results convey an important message in terms of defining a threshold of PA which is beneficial mainly for improving mortality.

To summarize, despite the critically importance of PA in older adults in the prevention of disease, maintenance of independence and improved quality of life, the level of PA is low in older adults. Maintaining and engaging in sufficient physical activity cannot be promoted solely at the level of the individuals and require concerted actions from individuals, communities, governments, policy, urbanism (environmental changes). Finally, there remain many questions in terms of defining a threshold of PA which is beneficial mainly for improving functional outcome in older adults, and to determine exercise classes specifically designed for adults with arthritis and reduced walking capacity.

Conflict of interest

The author has no conflicts of interest.

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