

The role of physical activity in the elderly as primary prevention

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Aerobic fitness in the older population is related to health status [5], all-cause mortality [9], and functional capacity [5, 9, 13, 14]. Stathokostas et al. [16] described longitudinal (10 years) decline in aerobic fitness-maximal oxygen uptake and submaximal aerobic power (ventilatory threshold) in a relatively large sample of men and women, aged 55–85 years, living independently in the community [16]. Ten years after initial testing, 62 subjects (34 men, mean age 73.5 ± 6.4 years; 28 women, 72.1 ± 5.3 years) achieved maximal oxygen uptake. The men showed a rate of decline of $-0.43 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}\cdot\text{year}^{-1}$, and the decline in maximal oxygen uptake was consequent to a lowered maximal heart rate with no change in the maximum oxygen pulse. The women showed a slower rate of decline of maximal oxygen uptake of $-0.19 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}\cdot\text{year}^{-1}$, again with a lowered maximal heart rate and unchanged oxygen pulse.

Evidence for the role of the muscles themselves in the reduction of maximal oxygen uptake is muscle atrophy [15] and the reduction in oxidative properties with age [7]. Recent *in vivo* measurements of whole muscle by magnetic resonance indicate a significant age-related decline in oxidative properties per muscle volume [3]. These *in vivo* whole muscle determinations point to a significant loss of muscle oxidative capacity that, combined with the observed reduction in muscle mass, may account for the reduction in maximal oxygen uptake with age.

Physical activity is one of the most important and effective ways to prevent and treat certain health problems in older adults. During physical activity, the body is using energy to move muscles. Exercise is a type of physical

activity that is designed to improve fitness. The importance of physical activity as a tool to reduce the risk of various chronic degeneration diseases in the elderly has been conclusively established in recent years. In 1992, the American Heart Association stated that regular aerobic physical activity plays a primary role in the prevention of cardiovascular disease [4]. However, as early as in the 1950s, the connection between a sedentary lifestyle and the onset of coronary artery disease with time was noted [10]. While addressing two different occupation populations, which differ mainly by their physical activity required at work, Morris and Heady [10, 11] demonstrated that the physically active population had less incidence of coronary artery disease compared to the sedentary population.

In agreement with the above findings [10, 11], two decades later, Paffenbarger et al. [12] illustrated the same phenomenon. In a 22-year follow-up of 3,686 San Francisco longshoremen, a cohort analysis assessed job activity (via energy expenditure) and risk factors for heart disease, morbidity, and mortality. The risk factors include cigarette smoking, blood pressure, blood cholesterol level, obesity, and glucose metabolism in relation to fatal heart attack. The study demonstrated an inverse relationship between energy expenditure and fatal heart attack, which was most evident in younger and middle-aged cohorts compared to aged subjects. Furthermore, the role of energy expenditure was still manifested when viewed against the influence of the other risk factors [8]. Along with the increased evidence associating lower level of physical activity with higher risk of death from heart disease [6, 18], data from longitudinal studies have emerged indicating the influence of physical activity on longevity and mortality from other chronic disease such as cancer, diabetes, hypertension, and osteoporosis [17]. In addition, regular physical exercise is the best antidote to many of the effects

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of aging. Major benefits from regular exercise include the following: favorable effects on fats in the blood, better handling of blood sugar, improved breathing, better endurance, improved balance, greater strength, stronger bones, improved sense of well-being, and better sleep. Studies are currently being done to determine the benefits of exercise programs for increasing life expectancy and decreasing the risk of or delaying disability as long as possible.

Physical activity is an important constituent of physical fitness. Moreover, fitness level can be true a marker of regular physical activity [6]. Physical fitness for the aged is composed of various components, such as cardiorespiratory fitness, body composition, muscle mass and strength, aerobic endurance, and flexibility. These variables and their adaptive response to regular physical activity result in an enhanced fitness level. Thus, a high level of physical activity, as measured via physical fitness level, may delay all-cause mortality, primarily due to lowered rates of cardiovascular disease and cancer. Blair et al. [1] found in 13,344 participants that the highly fit subjects at the highest level of either blood pressure or cholesterol had a lower risk of death than unfit subjects with low blood pressure or cholesterol level. However, fitness level alone is not the only indicator of future risk of coronary artery disease. Fitness level is comprised of both genetic predisposition and habitual physical activity [6]. Being highly fit yet inactive does not provide any protection against coronary artery disease. Furthermore, unfit though active men have a lower risk of coronary artery disease than unfit but sedentary men [6]. Hence, physical activity is the key to enhanced health status, rather than the fitness level by itself.

In particular, the present status of physical activity should be considered as a tool for primary prevention of chronic diseases. Williams [18] and, more recently, Chiuvè et al. [2] have shown that men who improved their physical fitness level reduced their mortality risk. Consequently, only the current activity level is associated with a lower rate of death from all causes and from coronary artery disease. This is the main principle in the reviews by Sagiv, “Alterations in IGF-I affect elderly: role of physical activity”, Ben-Sira, “Physical activity in aging and risk factors: primary prevention”, and Melendez, “Osteoporosis, falls and exercise” appearing in this issue. They discuss the importance of the role of exercise training in the aged as a primary prevention tool of chronic degeneration. In addition, they address the topic of the recommended amount of physical activity required for health promotion, along with providing current exercise guidelines.

Another way to integrate exercise into health care is to view it in the light of its potential to reduce risk factors for chronic diseases. The very large potential for exercise to act as a primary prevention tool is obvious from the kinds of risk factors and diseases listed. The major causes of morbidity and

mortality (heart disease, stroke, diabetes, cancer, arthritis, functional dependency, hip fracture, and dementia) in the older population are all more prevalent in individuals who are sedentary compared to more active peers.

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