Disability and Ageing

A lack of exercise during adult life is associated with deconditioning, fatigue, weakness, decrease in one's physical and mental health and well-being, the onset of disease, loss of self-esteem and self-efficacy, and an increase in depression and anxiety. The one intervention proposed to have the most eminent preventative and therapeutic impact on these age-related changes is physical activity. Physical activity for the elderly needs to take into account the individual's health status, fitness level and age. The relationship of these variables is very complex and variable to a number of factors. Therefore, the health fitness specialist should not view the elderly as being one homogeneous group. Although different terms are used in the literature, gerontologists have identified three broad categories of seniors: 1) old-old, or frail old, who are over 75 years of age, 2) young-old who are persons between 65 and 75 years, and 3) athletic-old, elders who have maintained a high level of fitness throughout their life (Elia, 1991) . This article will examine the relationship of exercise as it relates to changes with aging and provide guidelines for the health fitness professional in working with this spirited population.

Physiological Changes That Occur With Aging:

Many of the physiological changes with ages may more appropriately be associated with sedentary lifestyles. With the cardiovascular system there is a 20 to 30% decrease in cardiac output by the age 65. Maximal oxygen uptake decreases approximately 9% and 5% per decade, for sedentary men and women, respectively (Elia, 1991) . There is a loss in elasticity of the major blood vessels which contributes to a 10 to 40 mm Hg elevation in systolic and diastolic blood pressure. Maximum heart rate decreases approximately 10 beats per minute per decade, although resting heart rate shows little alteration with age. The respiratory system undergoes a 40 to 50% loss in forced vital lung capacity (total volume of

air that can be voluntarily moved in one breath, from full inspiration to maximum expiration) by the age 70. There is also a decrease in chest wall compliance, maximum ventilation and alveolar size. The muscular system undergoes a 40% loss of muscle mass and 30% decrease in strength by age 70 (Rogers & Evans, 1993) . It is interesting to note that the lower body is more affected than the upper body with this age-related muscle mass loss (Bemben, Massey, Bemben, Misner, & Boileau, 1991) . As far as muscular fitness is concerned, it appears that strength increases into the third decade of life, then plateaus through the fifth and/or sixth decade, and then declines rapidly thereafter (Bemben et al., 1991) . The big question facing researchers is to what degree strength loss is a function of disuse versus aging. There is a 1% loss of bone mass per year after age 35, with up to a 2 to 3% loss after menopause for women. Degeneration of the joints, specifically the spine is common. Connective tissues gradually lose their elasticity, muscle fibers shorten, and joints show decreases in the production of joint lubricating synovial fluid. By age 60, there is up to a 15% reduction in nerve conduction concomitantly with a reduction in neurons and brain mass. The blood undergoes a loss of hemoglobin (oxygen carrying protein), hematocrit (proportion of red blood cells to plasma), as well as red cell mass. There is an increase in the total cholesterol with a decrease in HDL (the good type) cholesterol. Finally, there is a loss of certain sensory sensations, such as thirst, eyesight, taste, balance, and hearing that occur gradually with aging.

Benefits of Exercise for the Aged

There are clearly many benefits that can be derived from participation in an exercise program for the mature exerciser. It is well-recognized that many deleterious physical and psychological conditions that commonly occur during aging can be prevented or delayed in asymptomatic persons with regular physical activity (Kligman & Pepin, 1992) . A summary of the benefits for the aged is presented in Table 1. Physical activity in elders has been linked to playing a role in the prevention of some cancers (Stevenson, Nomluran, & Grove, 1989) , as well as reduced risk

to heart disease, hypertension, osteoporosis, obesity, type II diabetes, osteoarthritis and abnormal cholesterol (Barry & Eathrone, 1994) . Mature adults who maintain high levels of cardiovascular endurance, strength, and flexibility are also less likely to be dependent for long-term care. Strength and flexibility exercises may prevent falls and injuries by improving balance and mobility. Falls have been shown to be the leading cause of fatal injury in people over age 75 (Barry, Rich, & Carlson, 1993) . Improved strength also helps individuals function independently, with improved gait and bodily control. Additionally, exercise is associated with effective stress management, fewer sleep disorders, enlightened mental outlook, reduced loneliness, and lowered depression and anxiety.

Will You Live Longer if You Exercise?

Early comparisons of university athletes with their sedentary peers failed to demonstrate any difference in longevity between the two groups. In fact, some evidence shows that many former athletes become overweight, inactive, smoke and drink more than their sedentary counterparts (Shepard, 1993) . Sheppard also described a Finnish study which documented that non-smoking cross-country ski champions lived an average of 3 to 4 years longer than their sedentary contemporaries. The well-known Harvard alumni study, following close to 17,000 male alumni over a period of 22 years, estimated that subjects beginning and continuing to exercise throughout their life by the age of 35 to 39 years of age were able to add 1 to 2 years to their life, relative to those following a sedentary lifestyle (Paffenbarger, Hyde, Wing, & Hsieh, 1986) . Data indicated that the optimal caloric expenditure per week spent in physical activity to achieve these results was approximately 1,500 calories. Thus, life expectancy (the average number of years of life for an age group at a given chronological age) may be moderately increased with regular physical activity. Yet there is no evidence that life span, the theoretical number of years a person may live (which is currently 100 yr), has been extended with an active lifestyle (McPherson, 1994) .

The Exercise Prescription

Although the benefits of exercise are unmistakable, how much and what types of exercise need to maintain and improve fitness is still somewhat uncertain. Several studies and reviews suggest that older individuals have a higher physical potential then what has generally been believed (McPherson, 1994) .

Pre-exercise assessment: Prior to exercise the use of the Physical Activity Readiness Questionnaire (PAR-Q) or a similar questionnaire as a simple screening tool (see Table 2), in conjunction with medical forms for physician evaluation, is recommended. A review of medications the individual is taking is recommended in order to assure there are no complications from the drug during exercise.

The risks of exercise in the aging population are more pronounced with individuals who have pre-existing cardiovascular disease or cardiac problems, chronic obstructive pulmonary disease (emphysema, asthma, chronic bronchitis), deleterious osteoporosis and arthritis, and uncontrolled metabolic problems (unmanaged diabetes) (Kligman & Pepin, 1992) . Kligman and Pepin also suggest that for the most part, an exercise prescription is appropriate for apparently healthy seniors, even if there is diminished flexibility and functional capacity due to a sedentary lifestyle.

Safety considerations: Safety is always a paramount concern with elder exercise programs. There are some unique challenges for the elderly with exercise prescription. This population is less adaptable to temperature changes. Since elderly individuals have a lower proportion of total body water, they are more susceptible to dehydration. Water intake needs to be regularly encouraged before, during and after exercise. The elderly are more susceptible to cold injuries because of their decreased ability to perceive ambient air temperatures adequately and respond appropriately. This may be due to decreased muscle mass, loss of subcutaneous fat, inadequate vasoconstriction, or the affects of medications. Therefore, clothing needs to be layered to adjust to varying temperatures. When outside, near any transportation roadways,

reflective attire is recommended. Poor air quality from pollution or traffic may be contraindicated for individuals with chronic obstructive pulmonary disease. Also, due to impaired foot sensation, many elderly have a lessened ability to detect blisters and other friction injuries. Because of decreased sensory abilities, such as eyesight and balance, it is best to perform exercise in well-lighted areas with user friendly equipment. Elders need to be educated to slow down and stop if they experience any health warning signs during exercise.

Set Realistic Goals: Before embarking on an exercise program, individualized, realistic, and attainable goals for the elder should be identified. For elders over 75, increased mobility and life skills function may be more applicable. Generally, mobility is impaired with this group, so, for the most part, they are unlikely to engage in vigorous activity. The American College of Sports Medicine recommends exercise tolerance testing before elders begin a vigorous training program. However, with many elders, there may be too many limitations to complete such a test adequately, which suggests that the appropriate activity may be low to moderate level activity. The overall goals of the exercise prescription should be to improve cardiovascular endurance, strength, body composition and flexibility.

Warm-up and Flexibility Exercises

Generally, with ambulatory seniors, a warm-up lasting 10 to 15 minutes is recommended for most physical activities. The first phase should include a low-level moving activity with the major muscle groups, such as walking. Next transition into some functional range of motion calisthenic-type movements incorporating the major muscles groups. In addition, specific exercises should be included to help meet the needs of the clients with limited movement capabilities due to arthritis and osteoporosis.

All programs need an adequate cool-down period which includes stretching exercises and a relaxation. Exercise programs for elders should initially attempt to improve flexibility (Barry et al., 1993) ,

especially for those with arthritis and other musculoskeletal limiting problems. Stretching exercises need to be performed in a slow, gradual and sustained manner. Hold stretches for 20 to 30 seconds. Make sure the students feel the stretch in the muscle, and not in the joint. Stretches should be taken to the point of limitation, not the point of discomfort. Due to the limitations associated with inactivity, stretching exercises may be recommended daily to help some elders regain functional range of motion in certain joints. Typical stretches should be included for the hamstrings, quadriceps, pelvic girdle, low back and pectoral area (Kligman & Pepin, 1992) . Stress proper body position and technique when doing stretches.

Aerobic Exercise for All-Around Health

For overall health benefits, and reduction of numerous health risks, some form of aerobic activity is recommended. The use of the large muscles in the body in activities such as walking, swimming, aqua exercise and cycling are examples of the many to choose from. Swimming and aqua exercise are excellent modalities due to the lessened stress on the joints. Similarly, stationary cycling (recommended due to thoroughfare hazards and risk of falling in road cycling) places less stress on the joints, while recumbent cycling puts less stress on the back. Walking, at a higher pace than normal walking, is one of the most viable options for ambulatory elders. It can be done easily in most environments and requires no additional equipment.

With elderly who have been sedentary, a progressive low-intensity aerobic exercise program is recommended. Gradual increases in duration and intensity are encouraged. In movement activities such as group-led aerobics, concern should be on sudden movement changes and elaborate choreography that may lead to falls. Some activities such as running or jogging may stress the knees and hips unnecessarily, and are thus not universally recommended for elders. Adhering to the new Centers for Disease Control and American College of Sports Medicine guidelines for Exercise Lite are recommended: "Every American adult should accumulate 30 minutes or more of moderated-intensity physical activity

over the course of most days of the week." In support of this recommendation for the elderly, research suggests that daily cardiovascular exercise is well tolerated by older adults (Watkins & Kligman, 1991) . Although the American College of Sports Medicine recommends an intensity of 50 to 85% of heart rate range to improve cardiovascular parameters, research denotes that 40% of VO2max may be sufficient for sedentary elders in eliciting an improvement in aerobic fitness (Hagberg, 1987) .

Strength Training: The Unsung Fitness Modality Hero

The participation in resistance training programs has demonstrated some clear and consistent results showing that elders 67 to 91 years of age can significantly improve muscular strength, functional mobility and balance (Munnings, 1993) . Also, with elders showing stable cardiovascular and musculoskeletal systems, there appears to be relatively few contraindications to strength training. Resistance training may not be encouraged with some hypertensive individuals due to elevated blood pressure. Arthritis sufferers may also experience some flare ups. The strength prescription for elders is very similar, though modified for fitness level, as prescribed for younger populations (Fleck & Kraemer, 1988) . However, it appears that researchers dramatically vary in their resistance intensity prescription. For instance, Fiatrone et al. (1990) have shown great muscular fitness results (and no injury) with frail seniors (average age 90 years) progressing rapidly to lifting resistances that are 80% of the subjects' 1 repetition maximum (1 RM). Contrariwise, other researchers have demonstrated significant increases in strength by beginning the muscular fitness programs using 30% of 1 RM, and progressing gradually up to 80% 1 RM (Parsons et al., 1992) . From the results of the research cited above, a resistance exercise program 3 days per week, progressing up to 3 sets of 8 to 10 repetitions (for each exercise) may be recommended. It should be noted that similar increases in strength and muscle mass are seen with elderly men and women (Pyka, Lindenberger, Charette, & Marcus, 1994) . Some experts prefer free weights to exercise machines because it develops posture and balance, while others prefer the extra support offered with exercise

machines. Accessibility may be the deciding criteria for equipment choice. To avoid excessively elevated blood pressures, elders doing resistance exercises need to be educated how to breathe regularly as they exercise, and keep from holding their breaths.

Motivating Elders to Exercise

Society has imposed many limitations on the elderly to be sedentary. Education to the pitfalls of inactivity and benefits of exercise need to be addressed. It is essential to realize that many seniors are anxious, tense, and nervous in an exercise setting, which may make them reluctant to try something new or different. Enjoyment and variety in program structure is highly advised. With careful attention to the program design, help the elderly learn to feel more comfortable with the inevitable changes that are occurring in their bodies. Meaningful conversation and discussion is encouraged. Rapport is essential. Allowing students the opportunity to express themselves lets them know they are being heard and understood. Demonstrating your interest in them will enhance their own self-esteem. Encourage all aspects of socialization with program activities. Offer attainable incentives and recognize those who achieve these targets. Be flexible with your program design, adapting appropriately to the welfare of the students. Most importantly, be supportive. As elders see themselves aging they often feel self-doubt and experience depression. Empower them to feel a sense of self-control with the success they enjoy through physical activity.

Improved Health Through Physical Activity Has No Finish Line

The persistent scientific association of exercise to improved health in the elderly is no coincidence. A sedentary lifestyle is a predisposition to disability, early death, and a depreciated quality of life. Educating the elderly to the positive aspects of including cardiovascular activity, muscle strength and flexibility in their life is a challenge for the health fitness professional. Awareness must be directed to the fact that chronological age does not really represent quality of health. As fitness professionals, we need to focus our attention on creating wonderful opportunities of lifetime fitness, for our students of all ages, and provide

a broad overview of health to a population with diverse interests and backgrounds. With the elderly, preventing the complications associated with inactivity is far more cost effective than having to pay the costs of long-term care.