Training Considerations - Ageing and Performance

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Physiological Decline

Irrespective of fitness level, physiological decline starts after maturity has been reached. For the highly trained athlete, however, the process can be held off until approximately forty years of age. These physiological changes take place in both the cardiorespiratory (CR) and cardiovascular (CV) systems and in muscular size and strength. There are other changes that will hamper performance but these are the ones dealt with here.

Respiratory Changes (cardiorespiratory)

The primary function of inspiration is to provide oxygen for the lungs to play their part in the cardiorespiratory process, while the purpose of expiration is to rid the body of waste products such as carbon dioxide. Within the lungs, a gaseous interchange takes place by way of the air sacs (alveoli). The efficiency of the lungs plays a vital part in aerobic endurance. The capacity of the lungs is physiologically divided into three areas:

- Residual air, which is air that is left in the lungs after full expiration.
- Tidal air, which is the ebb and flow of normal breathing.
- Vital capacity, which is the total amount of air that can be exhaled from full inspiration to full expiration.

With ageing the vital capacity of the lungs is reduced as residual air is increased. However, the total capacity of the lungs is not decreased, just the degrees of residual and tidal air. Between the early 20s and 50 years of age, the residual air within a person's lungs could increase from an average of 20% to around 30%, reducing the vital capacity of the lungs and consequently aerobic endurance. Other factors that reduce efficiency are to be found in the loss of elasticity in the lung tissue, and inflexibility of the rib cage.

These changes contribute considerably to decline in lung function. For an inactive person, these changes are not detrimental to an ordinary life style.

In the case where regular endurance training is undertaken by the middle aged and older enthusiast, these losses are greatly reduced. There is only a slight decrease in pulmonary ventilation capacity in older endurance athletes. Some authorities consider that the losses in VO2 max, as seen in older athletes could be, in part, the result of a reduction in the effectiveness of oxygen transportation, as with ageing, muscular tissue becomes less efficient in the extraction of oxygen.

Circulatory Changes (cardiovascular)

A notable feature of ageing is reduction in maximum heart rate (MHR). Irrespective of effort, the heart rate reaches a limit during exercise. The 220 minus age formula that is widely used for "guesstimating" MHR, can only be a rough guide, with a possible plus or minus of 15/20 beats per minute (bpm). A 60 year old would be estimated with a MHR of 160 bpm and work aerobically up to 80% of that (128 bpm), hence they would be working at a much lower heart rate than a 20 year old working at 80% of maximum (160bpm).

Reduction also comes about from the increased resistance offered by the peripheral blood vessels. Both the arteries and arterioles lose their elasticity and a reduction in their lumen (duct, or diameter). The circulatory system is responsible for the transportation of oxygenated blood to muscle tissue, and the removal of lactate from the tissues. Any deficiency in its function will adversely affect the aerobic level or oxygen uptake. Circulatory decline does equate with decline in endurance, with an estimated sedentary endurance rate loss of slightly less than 1% per annum, or 10% per decade, in sedentary people. The VO2 max of the regular elderly trainer far exceeds that of the non-active person.

The elderly person who is actively engaged in exercise and training is not following a natural behaviour pattern; with ageing, the tendency is to reduce physical stress and effort. Animal studies confirm this inclination. Nonetheless, this deviation from the accepted pattern of activity does have a beneficial spin off in quality of life and health. Reactions to ageing that occur within the CV system affect the ability of thebo dy to adjust the pressure within the arterial system. Inefficiency can result in restriction of blood flow to muscle tissue as can any restriction to the pumping action of the heart.

The heart is a muscle and responds beneficially to aerobic work. Though there are no claims for longevity, continued training into old age helps to delay considerably the onset of many of the problems that beset the aged and improves the quality of life.

Strength & Muscle Mass

With age there is a gradual decline in the ability to perform everyday tasks. Infirmity can be extremely physically demanding. One clear example of strength loss is weakness of the extensors of the knee joint, which results in difficulty in rising from a low seat and negotiating stairs. The increased participation in exercise groups and classes amongst the elderly does give rise to the assumption that they are becoming aware of the debilitating effects that inactivity in old age can bring. There is then much to be said for the continuation of exercise and activity in order to increase the quality of life.

Over the years there is a natural loss of muscle mass and a likely increase in subcutaneous fat (adipose tissue). Though a person may appear to have retained the same body weight, it is more possible that the balance between fat and muscle mass has changed. Weight training or progressive resistance exercise can be of great help in retaining a degree of muscle mass and tone in the middle aged and elderly.

Reduction in muscle mass can be viewed as being in two phases. The slow phase occurs between the ages of approximately 25 years and 50 years. This stage is hardly discernible in its early stages in those in hard training and the estimated loss is around 10%. The second stage is much more rapid, and by the age of 80 there is a possible 50% loss of muscle mass. Changes also occur between the fast and slow twitch fibres found in muscle tissue, with a loss of fast twitch fibres and an increase in the slow twitch fibres.

This change in the muscle composition helps to explain how performances requiring speed and reactions deteriorate with age. It could also explain the noticeable shift of the older athlete into sports and activities like distance running, rowing and swimming, where reaction and speed are not the prime requirement.

Losses in muscle strength and mass are not confined to old age. Muscle tissue is highly elastic and will respond to use and disuse. This is seen in the disuse atrophy (decay) occurring after trauma, such as knee injuries and limbs encased in plaster. With judicious remedial treatment, losses can be rectified with recovery, success being relative to age.

Ageing itself does not prevent skeletal muscle gaining in tone and strength. Elderly people who take up regular training can and do show relatively good improvement. Regular training cannot completely eliminate age related losses, however, regular exercise and training can increase aerobic capacity and strength in the elderly. If practical proof of this was needed, the British and World Indoor Rowing Championships showcase elderly athletes who portray the benefits of continued exercise and training.

Training

A positive state of mind, and a considerable degree of self discipline and sacrifice may be required to adopt a fitness training regimen into old age. Providing one is physically sound, the benefits that can be accrued will be well worth the efforts. Quality of life is important at any age, but never more so than in old age. It is always prudent to have a regular medical check up and elderly participants in exercise and training must always be aware of their limitations, and constantly adjust aims and objectives.

VO2 max decreases by 0.4ml/kg/minute/year on average. A man aged 25 who is at the peak of his fitness and weighs 80kgs has a VO2 max of approximately six litres/min. If his weight remains the same and he continues to train, at the age of 50 his VO2 max will have dropped to five litres/min. If, at his peak, his 2,000m best time is six minutes, this would fall to around six minutes 40 seconds by his 50th birthday as a direct result of the decline in VO2 max. This rate of decline is an average figure and includes sedentary people, but there are steps that can be taken to arrest decline. One of the first things is weight management. As explained above, muscle is lost through atrophy with increasing age. If you maintain your weight, then the ratio of body fat to muscle mass increases. Rather than just watching your weight, control your percentage body fat.

Muscle tissue burns oxygen while body fat reduces the VO2 per kilo bodyweight. A correct nutritional calorie balance, which is adequate in carbohydrates and protein and low in fat, is essential (see Diet by Majorie Hagerman in Section 8 : Nutrition and Weight Management) and allied to strength retention (see Section 7 : Weight Training). Exercise is the best way to manage your percentage body fat.

Training still needs to be varied and should aim to cover all the energy systems from low intensity aerobic work, through lactate threshold training up to high intensity anaerobic workouts. It is also important to continue to carry out the core stability exercises (see Core Stability Training in Section 7 : Weight Training).

Older rowers should take care to maintain the wave training principle to reduce the risk of over-training whilst still looking for progressive increments. By sticking to non-weight bearing, non-impact exercises like the Indoor Rower you will reduce the risk of muscle and joint damage.