Age related loss of muscle function – Peter Sandery

It's a reasonably sure bet that if you are a person of mature years who engages in athletic competition, then at some time someone has asked you, "Why do you do it"? A reasonable question as training and competing obviously involves a lot of effort and fairly obvious discomfit at times. A quick answer to the question is, "Because I can", but there are better reasons for doing what we do. These include a degree of personal satisfaction in setting a goal and then working towards achieving it, a few rare periods when you perform better than you expect, and the social outcomes from being part of a group with shared interests. There is, however, another important reason for people of mature years to undertake regular high intensity training and competition such as running, walking or field events.

As we age, we experience a loss of muscle function because of a decrease in muscle mass (atrophy) due to a decrease in contractile protein in muscle fibres, and actual loss of muscle fibres/cells. Unlike some other body cells (such as skin, intestinal lining, red blood cells, etc), muscle cells do not reproduce. The decrease in available muscle fibres is linked to failure of junctions between nerve fibres and muscle cells or may be due to various forms of cell damage. If a muscle cell is not activated regularly by a nerve impulse (innervation) it atrophies and eventually dies. Regular use is essential to maintain healthy function of a muscle cell. There is a repair function that replaces nerve cell junctions by stimulating nearby nerve fibres to branch and take over the faulty junction. With age, the capacity of nerve fibres to branch and replace inactive nerve/muscle junctions decreases.

Between the ages of 24 and 50 there is a small loss of skeletal muscle function due to around 10% decrease in cross sectional area of fibres and perhaps 5% loss of fibres. From 50 to 80 years around 30% of muscle mass and 35% of muscle cells may be lost. These percentages are approximate and vary with individuals. Sedentary people may not notice this muscle mass loss as it happens gradually and body mass may not decrease if body fat mass increases. Those of an athletic persuasion will see a gradual increase in race times, partly due to muscle loss and partly due to other factors such as decreased elasticity of connective tissue. When connective tissue is stretched, we get some of the energy back, adding to the contractile action of muscles. With age, less is returned as motion.

In general, we tend to lose fast twitch muscle (the fibres that give us quick, powerful movements) at a higher rate than slow twitch muscle. For masters athletes, loss of muscle mass and hence strength, has obvious consequences. In everyday life, we need this fast, powerful response for things like restoring stability if we overbalance or stumble. We also need strong skeletal muscles to generate mechanical strain on bones to keep bone density at a healthy level. Muscle mass plays a role in temperature regulation in the body and hence a loss of muscle mass results in decreased tolerance to high and low temperatures. Skeletal muscle mass is costly in metabolic terms for the body to maintain, regardless of age and hence is matched to the demand placed on the body – use it or lose it. Astronauts working in the space station have reported a significant loss of lower body muscle mass and bone mineralisation even after a relatively short time in space and despite using the admittedly limited gym equipment that is available to them. Age-related loss of skeletal muscle mass (sarcopenia) is

inevitable, but you can do something about the rate of loss and hence the muscle function you have at a given age.

Skeletal muscle tissue sustains some damage just through our daily activity. Because muscle cells cannot reproduce we would be in trouble without inbuilt repair processes. There are mechanisms at the muscle cell level that act to repair damage and to cause growth in the size of the cell (hypertrophy) by increasing the amount of contractile protein to allow fibres to better respond to subsequent similar physical demand. Repair of muscle cell structure and hence function, depends on a form of growth factor (MGF), which is produced in muscle cells by specific genes that are activated when muscles are overloaded mechanically (the “M” in MGF). This in turn can stimulate the liver to produce a more general form of growth factor (IGF-I) that circulates in the blood and also contributes to the growth and size (and hence strength) of exercising muscle fibres. Some research indicates that MGF may facilitate nerve repair and therefore could reduce the loss of muscle fibres because of innervation failure.

The bottom line? To maintain (or improve) muscle mass and hence strength you need to maintain the capacity to produce MGF in muscle cells to maintain muscle cell repair/growth mechanisms. Low demand activity just doesn’t meet this need. Regular high intensity (or resistance) training and competition provides a high level of demand on muscle fibres and hence acts to stimulate this function. This carries with it the risk of injury, but that risk can be minimised by incorporating a good warmup routine into your training; setting demanding, but appropriate training goals, and; monitoring and responding to any precursor signals of impending injury.

With increasing age, you will still lose muscle mass, but the rate of loss can be decreased by undertaking some forms of exercise that challenge all of your skeletal muscle. You still won’t retain the muscle mass and hence power you had in your youth, but you will be doing a lot better than your sedentary peers.