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Supporting health during exercise and training.

Exercise is an integral and essential part of a healthy and optimal lifestyle. The benefits of exercise are extremely well documented with overwhelming evidence that lifelong exercise is associated with an increased health span, delaying the onset of many chronic conditions and diseases.¹

One of the main reasons for this reduction in chronic disease, is that habitual physical activity stimulates anti-inflammatory pathways. One study demonstrated that physically inactive middle-aged women (engaging in less than one hour of exercise per week) experience a 52% increase in all-cause mortality, a doubling of cardiovascular-related mortality, and a 29% increase in cancer-related mortality when compared with physically active ones.² So it's important to consider the positive impact that physical activity can have on your health, and try to incorporate this routinely into your life.

However, with people who have a very active lifestyle, serious amateur or elite athletes, the impact of intensive training on overall health also needs to be considered. Whilst exercise and training have many positive benefits (improved muscle mass and function, cardiovascular function, blood sugar regulation and respiratory health), excessive amounts of training are associated with an increase in oxidative stress, cortisol and inflammatory markers, as well as a depression of immunity post-training. These factors in short doses aid improvements in performance and health resilience; however, in excess, and if recovery is insufficient, they can contribute to long term damage and immune suppression, including disruption to the gut microbiota, leading to injury and infections, as well as reduced training effects.

Oxidative stress

In our body, oxidative stress is occurring all the time, with cells continuously producing free radicals such as reactive oxygen species (ROS), as part of normal metabolic processes (body functions). These free radicals are neutralised by an elaborate antioxidant defence system consisting of enzymes such as superoxide dismutase (SOD), glutathione peroxidase, and numerous non-enzymatic antioxidants, including vitamins A, E and C, glutathione, ubiquinone, and flavonoids. As exercise increases metabolic turnover, it can lead to an imbalance between ROS and antioxidants, and therefore an excess of oxidative stress.³ A certain amount of oxidative stress is important for cellular regeneration, allowing for rebuilding of mitochondria in particular (our energy 'batteries'), as well as cell repair.

This process allows the body, particularly muscle tissue, to improve performance over time. However, often our antioxidant systems can become overwhelmed if there is i) too high a level of oxidative stress ii) reduced intake or production of antioxidants and/or iii) there are insufficient recovery periods in-between training sessions.

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Mitochondria

Mitochondria are our energy powerhouses or 'batteries', and are essential for all functions that occur in the body. When training, the requirement for mitochondria is increased due to an increased need for energy. Therefore, supporting mitochondrial function is considered to be of importance for maintaining and improving performance and recovery. Mitochondrial biogenesis (synthesis of new mitochondria) is constantly ongoing within skeletal muscle in order to maintain mitochondrial numbers and efficient production of energy. Oxidative stress post-training can stimulate increased mitochondria production, but *excessive oxidative stress* leads to increased damage - inflammation and mitochondrial destruction (in terms of quantity and quality of function). This is where the use of antioxidants, to help repair and regenerate cells including the mitochondria, can be very helpful. A study which investigated the relationship between oxidative stress and exercise recommends oxidative stress status monitoring, followed by appropriate use of antioxidants as a part of the training regime.⁴ The effects of antioxidant supplementation on exercise performance and recovery is based on the following:

- Mitochondrial adenosine triphosphate (ATP) production is not 100% efficient, so that superoxide radicals are formed in increased quantities during exercise. The more oxygen utilised during exercise, the more superoxide radicals are formed that need to be quenched
- Muscle damage results in excess free radical production and this prevents recovery
- Mechanisms for removal of the excess radical species are insufficient; antioxidant supplements can prevent the negative consequences of excess accumulation.

Vitamin D

Vitamin D deficiency, associated with oxidative stress in skeletal muscle, can lead to a reduction in muscle tissue, by disrupting mitochondrial function.⁵

Importance of Sleep

Sleep is an essential part of the recovery process and critical to improve training capacity and ultimately performance.

Post-exercise recovery is vital for all athletes. If the balance between training stress and physical recovery is inadequate, performance in subsequent training sessions or competition may be adversely affected. In addition, it can become a vicious cycle as muscle fatigue or soreness may adversely affect sleep, with inflammatory cytokines linked to disruption of normal sleep. Sleep deprivation is associated with increased catabolic (breaking down) and reduced anabolic (building) hormones which results in impaired muscle repair and growth, blunting training adaptations and recovery.⁶

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Nutrients such as tryptophan, magnesium, vitamin B6, glycine, and L-theanine can support restful sleep. Sleep can be promoted either by inhibiting wake-promoting mechanisms or by increasing sleep promoting factors through nutritional interventions. Based on one review of the existing scientific literature, there appears to be considerable scope for further investigation of nutrition interventions designed to enhance sleep quality and quantity or promote general health, sleep health, training adaptations and/or recovery in both general and athletic populations.⁶

Nutrients to Support Muscle Health

During exercise, muscle fibres are broken down and re-built and this is part of the anabolic process by which muscle mass is increased. Mitochondrial function is therefore essential for this as the process requires significant amounts of energy. It is also important that the body has sufficient intake of the building blocks needed to increase muscle mass. Nutrients important for new muscle synthesis, in addition to protein, are:

- Omega-3 Fatty Acids

Omega-3 fatty acids are important for the health of every cell in our body, by allowing membrane flexibility and fluidity of required nutrients in and waste products out. In addition to this beneficial effect on muscle health and mass, they help reduce systemic inflammation by inhibiting the release of pro-inflammatory chemicals (cytokines) from immune cells and improving the signalling efficiency of proteins that are involved in growth and hypertrophy. Research shows supplementation dosages ranging from 2 to 5g/day for a minimum of four weeks results in improvements in anabolic signalling efficiency, muscle strength outcomes and recovery, particularly post-exercise.⁷

- Magnesium

It is well known that magnesium is responsible for muscle relaxation and therefore muscles use significant amounts of magnesium in order to maintain normal function. Animal studies indicate that magnesium might improve exercise performance via enhancing glucose availability in the brain, muscle and blood; and reducing/delaying lactate accumulation in the muscle. Other studies have shown a positive association between magnesium status and muscle performance, including grip strength, lower-leg power, knee extension torque, ankle extension strength, maximal isometric trunk flexion, rotation, and jumping performance. Additionally, findings from intervention studies showed that magnesium supplementation might lead to improvements in functional indices such as quadriceps torque.⁸

Post-exercise immune suppression

When performing significant amounts of exercise as an amateur or elite athlete, it's important to support immune health as demanding exercise can depress the immune system, putting individuals at a higher risk of

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infections particularly of the upper respiratory tract. This may be due to the cumulative effects of repeated bouts of intense exercise with the consequent elevation of stress hormones, particularly cortisol and anti-inflammatory chemicals.⁹

Research demonstrates short-term suppression of the immune system following an acute bout of endurance exercise, known as the “open window” period. This window of opportunity may allow for an increase in susceptibility to upper respiratory illness.¹⁰ Another reason to ensure your training is balanced with the appropriate amount of rest, depending on your training experience and individual health needs, in order to support immunity and increase health resilience.

Supporting post-exercise immunity

Vitamin D is an essential nutrient which supports normal function of the immune system. Research has found that vitamin D insufficiency is often pronounced among most people in the UK; with both amateur and elite athletes it has been associated with increased frequency of upper respiratory tract infections (URTI). Seasonal monitoring and correction of vitamin D levels for normalisation of inflammatory chemicals and decrease in the occurrence of URTIs is definitely advised.¹¹

Intensive training can be associated with a reduction of the antibody secretory IgA (sIgA), associated with mucus membrane health of the gut, lungs and respiratory tract (amongst others). It has been recommended that sIgA levels should be monitored in athletes to assess risk status for developing upper respiratory tract symptoms and intestinal permeability (‘leaky gut’). Given that illness can disrupt training and performance, further research is required to better elucidate how stressors individually and collectively influence immunity and illness.¹² Supporting gut health is important for the production of sIgA and therefore is a useful intervention for supporting immune health and protecting against infection.

It is important to note that the body needs energy just to function in every-day life. The one thing I hear most people say, irrespective of exercise, is that they want more energy or that they feel tired during the day. The above information is therefore appropriate to everyone, particularly if you’re under increased stress, infection or other health challenges, as your body needs additional energy to overcome these.

Functioning is one thing, but living life well is altogether another.

For more information, or to help with your health and training needs, contact Amanda on 0777 379 6035 or amanda@amandaheading.com.

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