INFECTIONS of the nose, throat, windpipe (trachea) or the two airways that branch from the trachea as it reaches the lungs (bronchi) are common. These upper respiratory tract infections (URTIs) include the common cold, sinusitis and tonsillitis, and most are due to a viral infection. The average adult has two to three URTIs each year. We are constantly exposed to the viruses that cause these infections, but some people seem more susceptible to catching URTIs than others. Every day our immune system protects us from an army of pathogenic microbes that bombard the body. Immune function is influenced by an individual’s genetic make-up as well other external factors such as stress, poor nutrition, lack of sleep, the normal aging process, lack of exercise or overtraining. These factors can suppress the immune system making a person more vulnerable to infection.

EXERCISE AND ITS EFFECT ON THE IMMUNE SYSTEM
Exercise can have both a positive and negative effect on immune function and can influence an individual’s vulnerability to infection. The underlying reasons for this variability are multifactorial and include infectious, neuroendocrine and metabolic factors, with the diet and training regime of the individual also playing a role. For athletes, environmental factors such as travel and accommodation also contribute to the risk of infection.

Researchers have found a link between moderate regular exercise and reduced frequency of URTIs compared with a sedentary state and excessive amounts of exercise and an increased risk of URTIs. An epidemiological study carried out by Matthews et al. in 2002 on moderate to vigorous activity and risk of URTI showed that regular moderate exercise per day was associated with a 29% reduction in the risk of getting a URTI compared to individuals that had a sedentary lifestyle. Professor Nieman of Appalachian State University, USA showed that when moderate exercise is repeated on a near daily basis there is a cumulative effect that leads to a long-term improvement in immune response. His research showed that those who walk at 70–75% of their \( V_{O_2 \text{ max}} \) (volume of oxygen that can be utilized while exercising at maximum capacity for 1 minute) for 40 minutes a day have half as many sick days due to colds or sore throats as those who don’t exercise. Conversely, other studies have reported a 100–500% increase in risk in developing an URTI in the weeks following marathons and ultra marathons. Following strenuous exercise, athletes enter a brief period of ‘open window’ time in which they experience weakened immune resistance and are more susceptible to viral and bacterial infections, in particular of the respiratory tract.

Evidence of URTIs collected for this research is not usually based on detection of the virus in isolates but taken from medical records or via an individual’s response to questionnaires, so some of the reported sore throats may not be due to infectious agents but to non-infectious airway inflammation caused by allergies or inhalation of pollutants.

A ‘J’-shaped model (see diagram below) has been used to describe the relationship between the amount of physical activity that is undertaken and risk of URTI. There is some evidence that this increased susceptibility to infection is due to a depression in immune system function of the individual. Studies have shown that exercise causes
During moderate activity, NK cell activity is enhanced. Studies show that NK cells are recruited to peripheral blood during exercise and that the cells recruited respond to interleukin. Intense activity experienced by elite athletes involved in training and competing in endurance events such as marathons and ultramarathons has been shown to downregulate NK cell activity. This immunodepression is thought to be caused in part by prostaglandins.

HORMONES

Adrenaline

Adrenaline, often known as the ‘flight or fight’ hormone, is produced by the adrenal gland in response to physical activity. It is constantly produced in small amounts to maintain normal blood pressure. During exercise, larger amounts of the hormone are released into the bloodstream where it prepares the body for increased physical activity by speeding up the heart rate, diverting blood flow to the muscles, widening the airways, dilating the pupils and raising the blood sugar level. Increased NK cell activity during exercise may relate to adrenaline levels, since it has been shown that the increase in activity occurs within 15–30 minutes after subcutaneous administration of adrenaline to healthy individuals.

Corticosteroids

Corticosteroids are a class of hormones with a wide range of physiological functions that are produced in the adrenal cortex. They include glucocorticoids – the most important of which in humans is cortisol. Cortisol is known as a stress hormone as it is secreted at higher levels in response to stressful situations. Elite athletes involved in training and competing in intense physical exertion stress the immune system. Corticosteroids have been shown to inhibit NK cell activity in vitro and also in vivo when measured more than 24 hours after administration of the synthetic corticoid drug methylprednisolone. However, other studies have shown that NK cell activity increases 4 hours after cortisol is given. Whilst it is known that during intense physical exertion stress hormones temporarily lower immunity, further research is needed to determine how such exercise might influence NK cell activity.

GET A MOVE ON …

The message from current research seems to be that moderate exercise does have a positive effect on the immune system. So to keep colds at bay we should all go out for a brisk, daily walk.

Dariel Burdass, Head of Communications, SGM

Thanks are due to Professor Mike Gleeson, University of Loughborough, for reviewing this article.

FURTHER READING


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