

Editorial

Enhanced Health to Enhanced Athletic Performance - A Spectrum

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Advancements in sport science and medicine are often complementary. Scientists get excited when thinking about applying new advances from the medical field that have the potential to influence elite athlete performance. Likewise, training interventions used by the athletic elite often filter down to the recreational exerciser and may improve health. Elite performance enhancement and improving health outcomes are different ends of the same spectrum. While the elite athlete often does not immediately benefit from what the medical field has to offer at the health end of the spectrum, scientists often modify and experiment with the techniques to see if there is potential to find the correct mix to influence performance. Between health and the elite ends of the spectrum, is the recreational exerciser and often this is where the greatest improvements are to be gained.

During the four-year buildup to each Olympic Games there is an exponential increase in research related to the anticipated performance inhibitors, and to particular challenges that foreign athletes will face in the host city. Commonly much of this research is related to the environmental conditions. Expected high air pollution for the Beijing summer Olympics in 2008 may have been instrumental in stimulating the research interest of inspiratory breathing devices. Subsequently commercialized and marketed as applicable to both asthmatics and elite level athletes these devices were sold with adjustable levels of resistance for different populations.

Over the last decade, we have seen an explosion in the technology around monitoring training. Wearable Global Positioning Systems (GPS) combined with heart rate have become an extremely common tool used in the design and monitoring of athletes' training programs. While at the health end of the spectrum, pedometers have been re-labelled and marketed as fitness bands with companies trying to out-do each other with a multitude of incorporated features. The idea that every step needs to be measured is incorporated with various challenges to incentivize the accomplishment of mini goals- thereby building daily exercise adherence. Sometimes the technology enhancement becomes too successful, the most famous example of this is the now-banned swimsuits stemming from the advanced understanding of fluid dynamics combined with the use of new fabrics and individualized custom-fitting processes. Deemed unfair

to the record holders of previous years, ramifications are being felt long into the future with swimming records now harder to break after the new swim suit restrictions were implemented.

Some have labeled the London 2012 summer Olympics 'the beetroot games', due to the high consumption of the vegetable juice supplement. Beetroot juice has been shown to reduce the oxygen cost of exercise thereby improving endurance performances, while from a health perspective it has also been shown to lower blood pressure. Another popular supplement from this era was Beta-alanine, which has been shown to increase the concentration of carnosine in muscles leading to decreased fatigue in athletes and increased potential for total muscular work to be performed. Another strategy used at these games included muscle warming pants to more precisely maintain a particular elevated muscle temperature post warm-up and prevent. This is popular for high intensity, short duration events. Longer duration endurance events, especially those conducted in the heat, have traditionally relied on pre-cooling, which follows the hypothesis that having a larger heat sink allows a longer time-course before an athlete reaches critically high temperatures and is forced to decrease their pace. Many methods including cooling garments, ice vests, cold water immersion techniques, and even ingested crushed ice mixtures are used to cool athletes prior to competing. Frequently, combinations of these methods are used to optimize the pre-cooling effectiveness. Interestingly, pacing especially in the heat occurs prior to actually reaching critically high temperatures, thereby bringing in the interaction of centrally controlled (brain) processes. The concept of pacing and how to optimize pacing for certain distances is a fascinating research area receiving much attention.

Post event there is a school of thought that you need to recover as fast as possible to allow the body to be able to handle a greater training load, or alternatively to have the ability to perform at a higher intensity in subsequent sessions. Acute recovery strategies have recently been questioned as to whether they actually impair long-term training adaptation. Some researchers suggest that acute recovery interventions need to be periodized allowing recovery interventions to be implemented for important competitive events, but otherwise used sparingly to allow for greater training adaptations during more intensive training periods. Sleep is important for adaptation, and sleep research has also become popular with the obvious detrimental performance effects of poor sleep hygiene.

Deep Vein Thrombosis (DVT) stockings may have stimulated the athletic research into compression garments, with these commonly researched for in-competition and recovery use. A slightly greater compression is used during training with blood pressure cuffs while performing resistance exercises, also known as Kaatsu training this has for a long time been a popular method of stimulating skeletal muscle growth, especially in rehabilitation settings. More recently, much greater pressures are used in studies investigating

the use of ischemic preconditioning. Originally developed for cardiac surgery applications to protect against myocardial ischemic injury, the technique has been applied to skeletal muscle and used as a conditioning effect to try and increase exercise capacity. This is effected through alterations in oxygen delivery and blood flow by using repeated ischemia and reperfusion of the limbs via blood pressure cuffs.

Various interventions have commonly been used to maximize adaptation and peak for competition, particularly, altitude training and heat acclimation. Intermittent hypoxic training devices have been researched to try and determine their efficacy and an optimal dosage to stimulate the altitude training effects while not having to relocate to an effective altitude. The additive effects of heat and altitude training are one strategy being investigated by scientists. While high altitude

training is acknowledged to benefit performance at sea-level (when implemented correctly), it is still somewhat undecided if being heat acclimated gives any increased benefits beyond the psychological for exercise at more moderate environmental conditions. Coaches and athletes need to decide whether to invest in altitude or heat training camps or use a combination of methods in their final taper phase. The taper phase is arguably the most important phase in training program design. A well structured and implemented taper can increase performance and reap the benefits of the long preparation; however a poorly implemented or planned taper literally ruins months and years of build-up. In a few months we will witness the latest fruits of scientific endeavor, so what will be the legacy of the Rio 2016 summer Olympic Games?