RUNNING ECONOMY

Running economy is very important in determining an individual's ability to perform in distance running events and with appropriate training it can make a real difference to your performance.

Running economy is typically defined as the cost, or physiological exertion, required to run at a given speed. Traditionally it is measured by running on a treadmill under standard laboratory conditions, and although this is not the same as over-ground running, it gives a good indication of how economical a runner is and how running economy changes over time. In the laboratory, running economy is determined by measuring an individual's consumption of oxygen at a given running speed and is measured using a system that captures and monitors the percentage of oxygen inhaled and exhaled by the runner. This requires the use of a snorkel-like apparatus placed in the runner's mouth and a nose clamp to prevent inhaling or exhaling through the nose. Alternatively mask systems are placed over both the runner's mouth and nose.

Runners with good running economy use less oxygen and therefore less energy than runners with poor running economy. Over time, experimental results have shown that there is a strong association between running economy and distance running performance. An example of this relationship comes from a case study of American mile record holder Steve Scott.

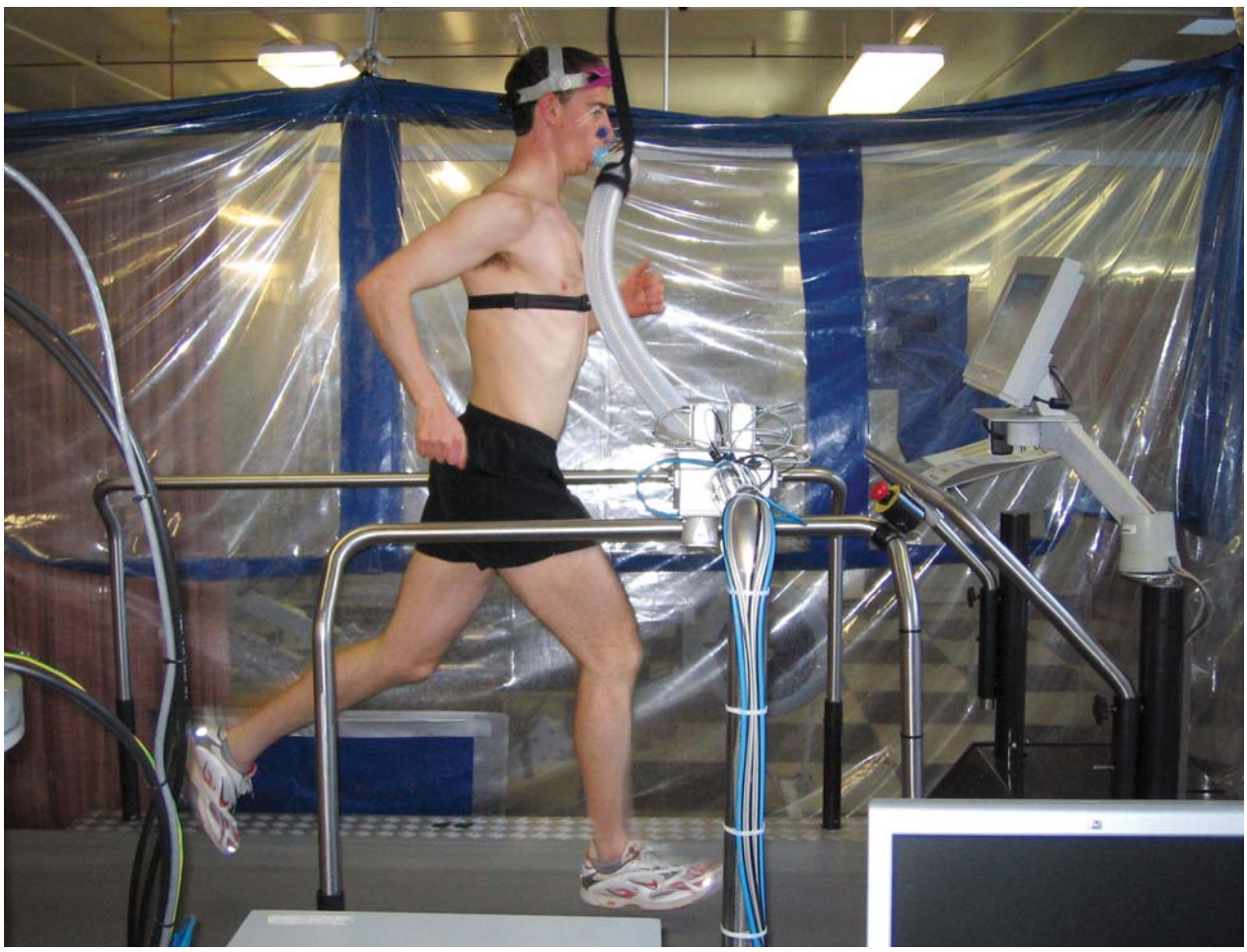
It was reported that during a 6-month period of training, Scott improved his running economy by 6.6% at a running speed of 16 km/h. During the same period of time Scott's maximal oxygen uptake increased by 3.8% (maximal oxygen uptake refers to the largest amount of oxygen that can be utilised by an individual). The combined improvement of running economy and maximal oxygen uptake reduced the relative intensity of running at 16 km/h by a massive 10%. That is, when running at 16 km/h Scott was now only working 90% as hard as he was six months earlier. These improvements were also associated with improved performance demonstrated by Scott breaking the 14-year old American mile record shortly after this laboratory testing, running a time of 3:49.68

How it's tested

Under controlled conditions, running economy is a stable test capable of detecting relatively small changes caused by training or other interventions. The treadmill test used at the Australian Institute of Sport to determine running economy requires subjects to run for 4 minutes at given running speeds. The running speeds used to quantify running economy at different periods in training and racing are 12, 14, 16, and 18 km/h. The 4-minute stages were determined to be the minimum duration required for oxygen consumption to reach a steady state, with running economy defined as the oxygen consumption during the last minute of each 4-minute stage.

Findings

A number of physiological and



AND PERFORMANCE

By Dr Philo Saunders

biomechanical factors appear to influence running economy in highly trained runners. These include metabolic adaptations within the muscle such as increased mitochondria and oxidative enzymes, the ability of the muscles to store and release elastic energy by increasing the stiffness of the muscles, and more efficient running mechanics leading to less energy wasted on braking forces, excessive vertical oscillation and rotation.

How to improve running economy

Although running economy has been researched extensively and its importance to performance is unquestioned, there are still relatively few documented training methods that have been shown to improve running economy of highly trained distance runners. Two methods that have received recent attention are plyometric training and altitude training. It has been suggested that altitude exposure may modulate discrete metabolic aspects of the working muscles, which facilitate more efficient use of oxygen. Also, plyometric training may allow muscles to utilise more elastic energy and reduce the amount of energy wasted in braking forces. Given that well designed plyometric training has other benefits, besides the potential to improve running economy, it would seem a useful addition to any athletes training program.

Recent research at the AIS has demonstrated improvements in running economy of up to 4% after a 9 week plyometric training intervention, compared to a matched control group not undertaking the plyometric training.

In the next edition of Lab-rat, we will talk in more detail about the exercises utilised in this study and give a demonstration on how to perform them.