Leicestershire & Rutland Coaches Club

Inspiring those who inspire others

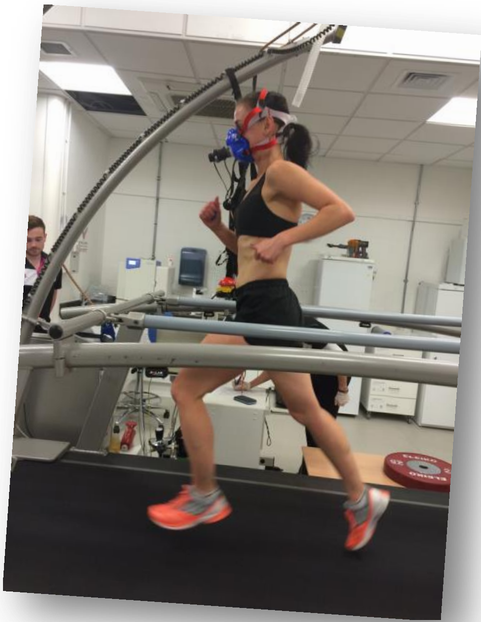
Leicestershire Vision 2020 Athletics Network

Using science to back up the "art" of coaching

Coaching- "art or science"? For anyone that has attended any of my workshops this question is raised regularly by me as it fascinates me to see how different coaches look at themselves and what philosophy they utilise with their training, there is no correct answer though as an "art" based coach my view is that coaching is an art backed up by science. This article gives an insight into how some science can help plot an athlete's success. As a background the test that was carried out measured the following aspects of an athlete's physical composition and included.

VO_2 max
Lactate Threshold (LT) & Lactate Turnpoint (LTP)
Running Economy
Velocity at VO_2 max

A detailed explanation of what this measured and what these terms mean is shown below at the end of this article.



Athlete Goals and Aspirations

Our V35 Athlete has several goals for 2015 amongst them are to gain qualification for the England team at the Home International Master XC for which she will require a maximum 10k PB of 37:30. This equates to an average speed of 16km/hr, which is 1km/hr above her LTP. Her current PB of 38:44 equates to a speed of 15.5km/hr. Whilst this was achieved quite a while ago, it is obvious that there will need to be a raise the speed at which Lactate turnpoint (LTP) occurs, and/or improve endurance at the threshold. This target is thought to be attainable with appropriate training loads as improvement has been substantial over the past year and qualification was only missed due to illness in 2014. The test that was carried out backed up the view that with continued progression that this would be attained in 2015 barring injury or illness.

Track 1500

A more recently agreed target was firstly to make the final in the world masters 1500 (Lyon) in August 2015 with a stretch target of gaining a medal at this level. The athlete concerned has a 1500 PB of 4.44 though this was achieved as a 21 year old. The current age PB achieved late in 2014 of 4.53 will require revising during the year to make these goals achievable. Although on the face of it a very difficult task, age grading indicates that this time equates similarly to the time (which was attained in isolation)achieved in 1998 as a 21 year old so fitness is very much on a par with then when less specific 1500 training was taking place. In such case as a coach the following will be considered as a way to achieve the athletes targets

Training implications – What sessions will help achieve the goals set.

There is a large anaerobic component to 1500m racing, but from the variables that have measured, VO_2max and velocity at VO_2max are most important, so improving these would be highly beneficial . Velocity at VO_2max is determined from VO_2max and running economy, so improvements in either of these would also be beneficial. Running economy takes a long time to improve significantly, so focussing on VO_2max will give greater short-term gains.
Therefore the 3 key aims moving forwards should be:
* Improve endurance at LTP/raise this threshold
* Improve VO_2max
* Maintain a good aerobic base (improve endurance at LR/raise this threshold) - to maintain a good base for the higher intensity training.

Improving Lactate threshold

In order to shift LT there is a need to build up mileage around this speed, which is 12km/hr. Long runs (>60minutes) should be done in Zone 2 (easy zone – see chart below), whilst runs of 45 - 60 minutes can be done a little above LT, so in Zone 3 - steady. It will be really important that the athlete doesn't go too fast otherwise the required adaptations will not occur. Currently long runs are being carried out at pretty much the right speed - around 13km/hr which is 7:26 min/mile pace.
Other sessions to improve LT are:

Long reps: these reps should be done at a heart rate a little above LT (2 - 3%) higher, and should last 5 - 20 minutes (increase the duration as fitness improves), with the recovery being half the duration of the rep and at a heart rate about 15% lower than LT. 2 - 5 reps should be completed with a reduction in the number of reps but an increase in duration as fitness improves.

Short reps: These are very short reps but lots of them need to be done to accumulate time spent at/above LT. These sessions are best done on a track or somewhere that speed can be assessed accurately. Reps are 1 minute long, with 10s recovery (walk). Heart rate should be 4 - 5% higher than LT during the rep. The athlete should aim to complete 20 - 50 reps.
The idea with these last 2 sessions is to drag LT up from above - ie run a little above LT intensity, then allow the body to recover (ie clear the lactate that started to build up), and then repeat. So whilst the long runs below or a little above LT are improving endurance at LT (ie improving how long that be can run at that pace whilst still using predominantly fats), these sessions are about trying to get the body better at using fats at slightly higher speeds.

Explanations of what each test term means and what was tested

VO_2 max

The maximum capability to use oxygen was assessed, which is an indication of endurance potential. Good aerobic endurance is important for distance running in order to be able to sustain a high work rate and also to help you recover between bouts of effort and between training sessions.
The VO_2max is 61.5 ml/kg/min, which is very good. Good club level runners would have a value between ~55-65 ml/kg/min and elite female endurance athletes would be in the 70s . This isn't an area that is currently limiting performance however to make significant improvements, it is an area that might benefit from improving.

Lactate Threshold (LT) & Lactate Turnpoint (LTP)

Lactate threshold occurred at 13 km/hr and at 79% of your VO_2max, whilst lactate turnpoint occurred at 15km/hr and 90% of VO_2max. Generally the highest percentage of VO_2max that can be sustained at these points is ~80 and 90% respectively, so there isn't much room to raise thresholds before being limited by VO_2max/running economy .

Running Economy

Running economy refers to the energy cost (highlighted by oxygen consumption), relative to the athlete's body weight, and speed at which they are running. The more economical the athletes is, the less oxygen that will use for a given speed. Running economy ranged from 227 - 218ml/kg/km (the lower the number the better). Elite endurance athletes will have values around 190 - 200ml/kg/km with good recreational/club runners having values around 210 - 220ml/kg/km .

Economy becomes more important the longer the duration of the race - having a greatest impact on marathon distance and beyond. The most economical athletes tend to be those who have accumulated most miles in training (and people also tend to be most economical at the speeds at which they accumulate the most miles). Other things that have been shown to improve economy are explosive strength training, plyometrics and incorporating dynamic running drills into a warm-up routine.

Velocity at VO_2 max *is a combined measure of economy and VO_2max and is closely related to endurance performance. Velocity at VO_2max is a key speed to train at for improving VO_2max and increasing running speed at VO_2max. The speed for this athlete was measured at 16.5 km/hr. An example of a training session to improve VO_2max and velocity at VO_2max based on this would be 4 x 4 minutes at this speed.*

Training Zones

LACTATE THRESHOLD (between Zone 2 and Zone 3)

ANAEROBIC THRESHOLD (between Zone 4 and Zone 5)

		Duration	Heart Rate (b/min)	Speed (km/hr)	Speed (min/mile)	Exertion	Adaptations
Zone 1	Recovery	30 mins	< 158	< 12	< 08:03	<11	Increase blood flow
Zone 2	Easy	1 - 5 hrs	158 - 166	12 - 13	08:03 07:26	11 - 12	Increase fat burning
Zone 3	Steady	30 mins -2 hrs	166 - 172	13 - 14	07:26 06:54	12 - 13	Improve aerobic base
Zone 4	Fast Steady	**20 - 40mins** e.g. 3 x10, 1min recovery, 2 x 20min 2min recovery or 1 x 30min	172 - 178	14 - 15	06:54 06:26	14 - 15	Quality mileage for aerobic development - shift the LTP up from below
Zone 5	Tempo	**15 - 25mins** e.g as one run session or included within a longer run	178 - 182	15 - 16	06:26 06:02	16 - 17	Pull the LTP up from above.
Zone 6	Intervals / VO_2 max	**Short: 20 - 60s**, e.g 20 sprint, 40 recovery, or 60 on, 60 off. **Long: 1 - 4mins**, e.g. 3/4mins on 1:30 off, 2mins on, 2mins off.	> 182	> 16	> 06:02	18 - 20	Increase VO_2max

John Skevington UKA Level 3 Performance Coach

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