# Physiological Assessment: Summary Report

26 May 2010

# Sonia Samuels

10km Athlete

## Test conducted and report compiled by:

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## Contents:

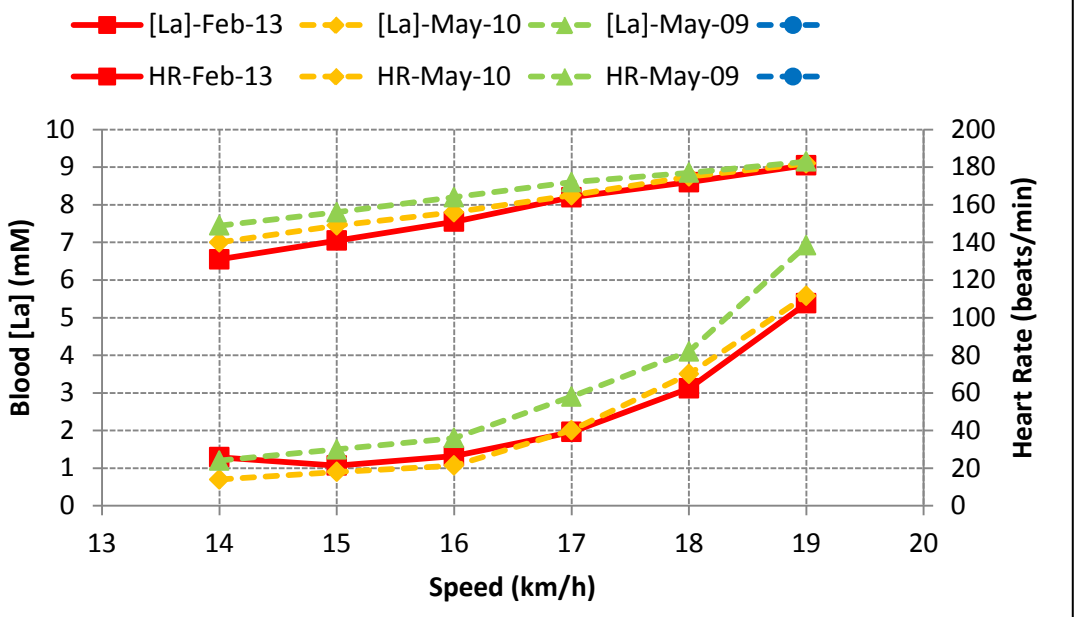
## 1. Athlete Characteristics

| | |
|---|---|
| Athlete: | Sonia Samuels |
| Event: | 10km |
| Personal Best: | 33:24.00 |
| Date: | 08 February 2013 |
| Location: | Loughborough |
| Date of Birth: | 16 May 1979 |
| Age: | 33 |
| Sex: | Female |
| Body Mass (kg): | 46.8 |

***Abbreviations:*** Lactate concentration ([La]); heart rate (HR); lactate threshold (LT - see explanation below); lactate turnpoint (LTP - see explanation below); oxygen uptake($VO_2$); maximal rate of $VO_2$ ($VO_2$max - see explanation below); speed at $VO_2$max (v$VO_2$max - see explanation below).
***The test:*** Included 3 parts: part 1 was a warm up of 10 min (1 km/h below the first running speed of part 2); part 2 included 3 min progressive stages to just above LTP with 30 sec between stages to collect blood for measuring [La]. Following a rest period, part 3 was started at 2 km/h below the finish speed of part 2 and the treadmill was increased by 1% every 1 min until volitional exhaustion. HR and $VO_2$ were measured at all times. The test is designed to monitor progression in key variables (see sections 2, 3 and 4 below) and also to generate accurate

## 2. Test Profile

| Stage | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Speed (km/h) | 14 | 15 | 16 | 17 | 18 | 19 |
| Speed (min/mile) | 06:53.8 | 06:26.2 | 06:02.1 | 05:40.8 | 05:21.9 | 05:04.9 |
| Lactate (mM) | 1.3 | 1.1 | 1.3 | 2.0 | 3.1 | 5.4 |
| Heart Rate (beats/min) | 131 | 141 | 151 | 164 | 172 | 181 |
| $VO_2$ (L/min) | 2.35 | 2.49 | 2.71 | 2.95 | 3.14 | 3.23 |
| $VO_2$ (mL/kg/min) | 50.1 | 53.2 | 57.8 | 63.0 | 67.0 | 69.0 |
| Economy (mL $O_2$/kg/km) | 215 | 213 | 217 | 222 | 223 | 218 |

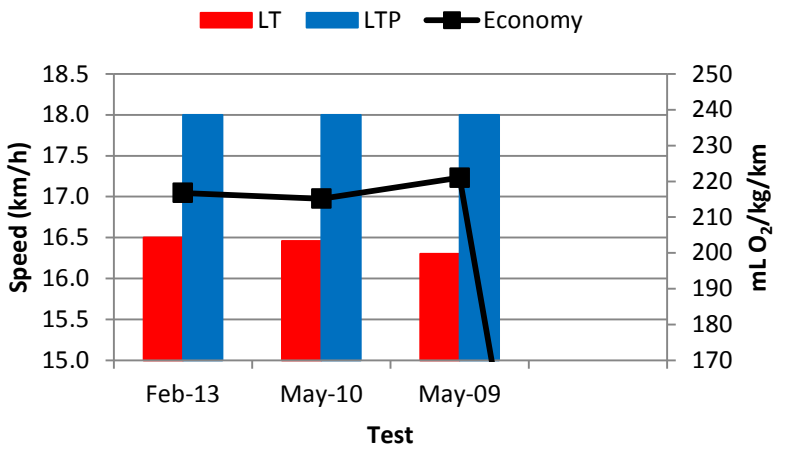



**Shifting the LT and/or LTP to a higher speed is an important goal of endurance training:** The [La] at any speed should be lower (downward shift in the [La] curve) and the LT and LTP should occur at higher speeds (rightward shift in the [La] curve) with endurance training. In addition, HR should be lower for a given speed (downward shift in HR curve).

Test profile comments: As you can see from the graph above, your lactate profile is very similar to your last visit in May 10. This is a postive sign, as this is a much earlier point in the season, and you still have a good chunk of training before we reach May for further progressions to occur. Great work

## 3. Submaximal Aerobic Physiology

| Test: | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Date: | Feb-13 | May-10 | May-09 | |
| Body mass (kg): | 46.8 | 47.0 | 47.0 | |
| Lactate threshold (km/h) | 16.5 | 16.5 | 16.3 | |
| Lactate threshold (min/m | 05:51.1 | 05:52.0 | 05:55.4 | |
| Lactate turnpoint (km/h) | 18.0 | 18.0 | 18.0 | |
| Lactate turnpoint (min/m | 05:21.9 | 05:21.9 | 05:21.9 | |
| Economy (at 16 km/hr): | 57.8 | 57.8 | 60.4 | |
| Economy (mL $O_2$/kg/km): | 217 | 215 | 221 | |




Submaximal physiology comments: Your lactate threshold and lactate turnpoint are very similar to your previous test, and you have also maintained your economy. This means your training zones will be very similar too, so do take some time to look through the paces set out on the final page and how they fit with your current training.

## 4. Maximal Aerobic Physiology

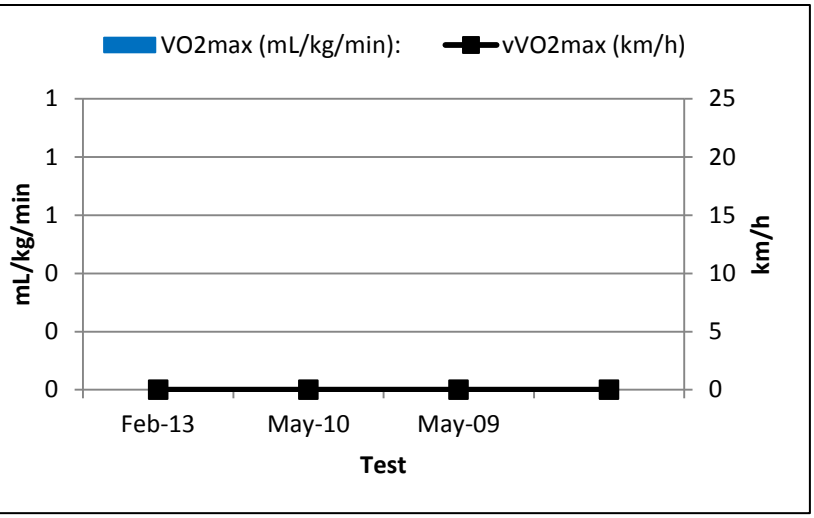
| Test | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Date: | Nov-11 | | | |
| $VO_2$max (L/min)): | 0.0 | | | |
| $VO_2$max (mL/kg/min): | 0.0 | | | |
| v$VO_2$max (km/h): | 0.0 | | | |
| Final Speed/Gradient: | 0.0 | | | |
| HR at max (beats/min): | 0.0 | | | |
| [La] at max (mmol/L): | 0.0 | | | |

It is important to note that there are actually two thresholds – the LT and the higher LTP.

***Lactate Threshold (LT):*** This is the first increase in blood [La] above baseline values. The speed at the LT is a strong predictor of the average speed that can be sustained in the marathon. The speed and heart rate at the LT are also useful in defining the transition between "easy" and "steady" running (see section 5 below).

***Lactate Turnpoint (LTP):*** The LTP is the running speed at which there is a distinct "sudden and sustained" breakpoint in blood [La]. Typically, this occurs at 2.0-4.0 mM. The LTP tends to occur at ~ 1-2 km/h above the LT (the difference is smaller in longer distance specialists and larger in middle-distance runners). The LTP can also be used to define the transition between "steady" and "threshold" running (see section 5 below).

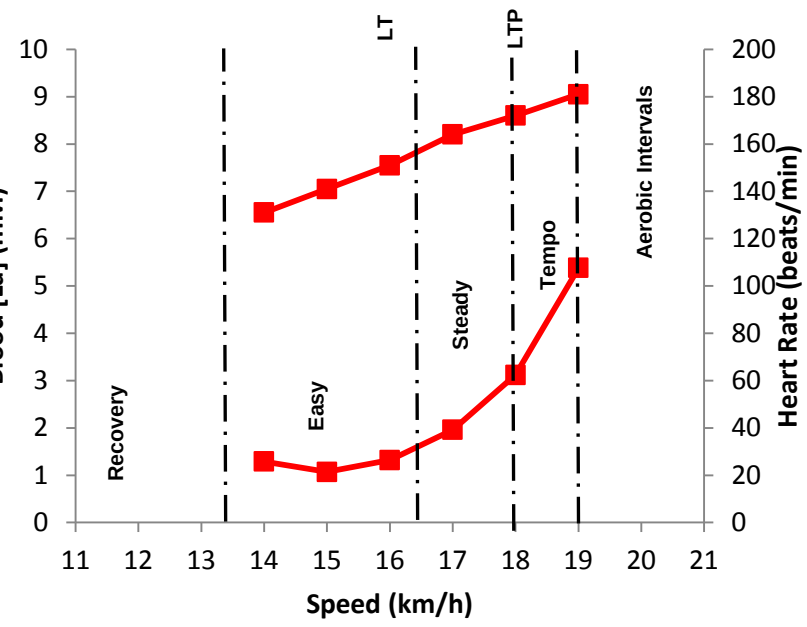
***Running economy:*** This is the $VO_2$ required to run at sub-maximal speeds. Running economy tends to be better in elite runners (i.e. their $VO_2$ is lower at a given speed) and it is associated with improved performance. A common method for assessing an athlete's running economy is to look at the $VO_2$ in ml/kg/min at 16.0 km/h and 1 % grade (i.e. 6:00 min/mile pace). The average in well trained runners at this speed is 52 ml/kg/min. Running economy can also be expressed in units of mL $O_2$/kg/km. Irrespective of running speed, the average economy is 200 mL $O_2$/kg/km.




Maximal physiology comments: No max test this time around.

General comments: Everything is looking positive Sonia. Although it would have been nice to have completed an extra stage to get a better picture of your top end, your legs were understandably heavey from the previous session and travelling home. It is worth re-iterating that, although your physiology may appear the same as the last visit, this is a much earlier point in the season and we would expect further progressions to come.

## 5. Guidance for Training




***$VO_2$max:*** This remains an important measure of performance capability in middle and long distance running. While factors such as economy and LT/LTP can partially compensate for a relatively poor max in elite groups, entry to those elite groups is still limited by $VO_2$max (i.e. the highest rate at which ATP can be resynthesised aerobically). It should be noted that $VO_2$max tends to be highest in athletes who specialise in events that are run close to $VO_2$max (that is, 3000 m and 5000 m). Other factors may be more important at shorter and longer distances.

***The speed at $VO_2$max ($vVO_2$max):*** The $vVO_2$max can be useful in predicting performance over 3000 m (and also 1500 and 5000 m). $vVO_2$max is simply calculated by multiplying the $VO_2$max (in mL/kg/min) by 60 and divided by the mean running economy determined during the first 4-5 stages of the treadmill test (in mL $O_2$/kg/km).

***Training zones:*** The speed and HR training zones given below are based around physiological landmarks (see explanation to the left) - the precise boundaries are defined according to the thresholds we've established today.
*When @Sea level:* Speed is the preferred option to monitor the correct intensity of your session.
*When @Altitude:* It is important to realise that speed zones wont reflect the actual intensity zone so you will need to use the heart rate zones in this circumstance. Remember - it takes a good few minutes (3 to 5 min) for HR to come up to the level required.

| | HR (bpm) | | Speed (km/h) | | Speed (min/mile) | | 400m lap (sec) | |
|---|---|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High | Low | High |
| Recovery | < | 126 | < | 13.5 | < | 07:09 | < | 106.7 |
| Easy | 126 | 157 | 13.5 | 16.5 | 07:09 | 05:51 | 106.7 | 87.3 |
| Steady | 157 | 172 | 16.5 | 18.0 | 05:51 | 05:22 | 87.3 | 80.0 |
| Tempo | 172 | 182 | 18.0 | 19.0 | 05:22 | 05:05 | 80.0 | 75.8 |
| Aerobic Intervals | 182 | max | 19.0 | 20.0 | 05:05 | 04:50 | 75.8 | 72.0 |

Key: < means less than

***Recovery Running:*** A lighter training load for recovery work or if you are feeling a bit fatigued.

***Easy Running:*** Easy running is used in long runs, supplementary runs, warm-ups, cool-downs and active recoveries between higher intensity intervals. The primary benefit of easy running is that it enables you to run more distance without greatly increasing stress on your body.

***Steady Running:*** Steady running is executed above LT but below LTP. At the lower end of the zone, this involves medium to long workouts and at the higher end of the zone , this involves medium to short workouts. All workouts regardless of duration are all generally run at a fairly constant pace. The athletes should get tired as a function of volume not the intensity of the session.

***Tempo Running:*** Tempo pace is traditionally defined as the running pace at which the blood lactate level begins to spike – that is, the LTP. Tempo runs are traditionally run just above LTP at the lower end of the zone and are generally constant pace efforts for a relatively prolonged period of time. They typically take the form of a sustained effort with the primary purpose to increase the pace one can sustain for a prolonged period of time and increase the time one can sustain a relatively fast pace. Many coaches and runners do longer tempo runs at slower than true tempo pace. Additionally, some runners gradually build up the intensity of a longer tempo run until actually running at tempo pace for the target duration. Both these practices can yield positive results.
On the other hand, tempo paced runs at the upper end of the zone (sometimes referred to as extensive aerobic intervals) can span a wide number of sets and reps. They should have built into them sufficient rest or slow work to allow complete recovery between reps or sets. This design format ensures that there is no accumulated fatigue between sets or reps allowing maintenance of quality rather than a reduction in performance caused by fatigue. The aim of these sessions is to get the body used to working intermittently above LTP and practice recovering after each effort.

***Aerobic Intervals (sometimes referred to as intensive aerobic intervals):*** The reps and sets of these types of sessions are designed in such a way that during each interval and during the workout there will be an accumulation of blood [La] often between 5-12 mM by the end of the session. The main goal however is to maximally challenge the aerobic as opposed to the anaerobic system. To do this, the distance or time governing each rep usually needs to be a minimum of 3 minutes (as it takes around 2 minutes to reach the point where the body is operating at $VO_2$max – the purpose of the workout). If performing shorter duration reps (e.g. 1 minute reps) then recovery must be reduced so that one is not fully recovered before the start of the next rep. Using this practice, after several intervals one may reach $VO_2$max in a much shorter duration thereby accumulating more time at $VO_2$max. Therefore the amount of recovery taken between repeated runs should be equal to (if taking active recovery), or a little less (if taking complete rest – generally half the rep duration) than the rep duration. The athlete should be able to perform each rep at the same velocity and with the same technique throughout the session.