Component 4 Performance Analysis- Athletics/5000m runner

Physiological Component

The fitness components needed for a long distance runner are…

- ✓ flexibility
- ✓ muscular endurance
- ✓ aerobic endurance
- ✓ body composition
- ✓ anaerobic endurance
- ✓ speed

Components of endurance running- 3 most important

Aerobic endurance

5000m is a continuous running race, where the whole body needs to be supplied with oxygen as the muscles work continuously with no breaks, otherwise there is a buildup of lactic acid, resulting in fatigue and lack of performance.

Muscular endurance

Having good muscular endurance your muscles are able to work for longer, 14 minutes +, and onset of fatigue is delayed.

Body composition

Endurance runners tend to have a low body fat percentage as they want minimal weight to carry when racing but also need muscle to carry their body weight for long periods of time.

Test for fitness components (see appendix for test protocols)

"Fitness tests are conducted to identify and 'establish the strength and weaknesses of an athlete" [16]
Validity = "is built around the question, 'does each test measure what it aims to measure'." [2]
Reliability = "whether you would get the same results each time if repeated." [2]

Aerobic endurance (see appendix for protocols)

VO2 max Test

Validity- measuring your VO2 max, which is relevant as your muscles need to be supplied with plenty of oxygen during the race.
Reliability- requires expensive equipment therefore it's hard to conduct or replicate.

I was able to complete this at Essex University, during the A level PE trip provided by our school.

	Myself	Average Professional
Max o2 uptake (ml/kg/min)	53	56+

Muscular endurance

Press ups test

Validity- this measures the muscular endurance of your arms.
Reliability- easy to conduct therefore easy to replicate and repeat, as it has minimal equipment and can be self-measured.

	Myself	Average professional
Number of squats	15	25

Body Composition

Skin fold caliper test

Reliability- consistency and the test results are repeatable.

Validity- the test aims to measure the percentage of fat, muscle and bone with a skin fold caliper. This is relevant because for an endurance athlete their somatotype is usually an ectomorph which consists of very little fat as they don't want to carry extra weight.

	myself	Average professional
Percentage of body fat	15 %	12% or lower

Future planning and training

My target is to improve muscular endurance, allowing me to run further for longer and quicker. I need to apply progressive overload, building the strength in your muscles.

Technical component- running style and technique for a long-distance runner (5000)

Different running techniques and styles can be used to maximize performance…

Some people have different running styles that suit their specific build. The three main somatotypes are, mesomorph, endomorph and ectomorph. Ectomorphs are more likely to take part in events like high jump and mesomorphs would compete in sprint events. I need a combination of both.

The ideally perfect running style for a 5000m runner

I'm going to look at, head, shoulders, arm action, body, hip alignment, knees and feet. Fast distance runners to achieve their best have a longer stride length but this repeatedly puts force on the runner's leg muscles.

- By running leaning forward and keeping straight line position reduces the amount of energy you use and reduces the risk of knee injuries such as patellofemoral joint pain.

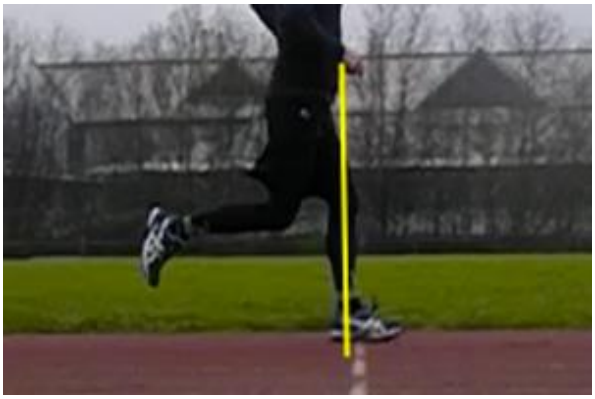
-Running tall allows your hips stay upright, so hips don't drop, this enables to drive your knees forward.

-Head tilt, links with running tall, it decreases tension and produces a more control and natural running movement.

-Position of shoulders, when correct this allows you to keep good posture. They shouldn't dip from side to side with each stride. If you lean too far forward with your shoulders, your pelvis will tilt forward resulting in added pressure on the lower back. Throwing alignment of the body.

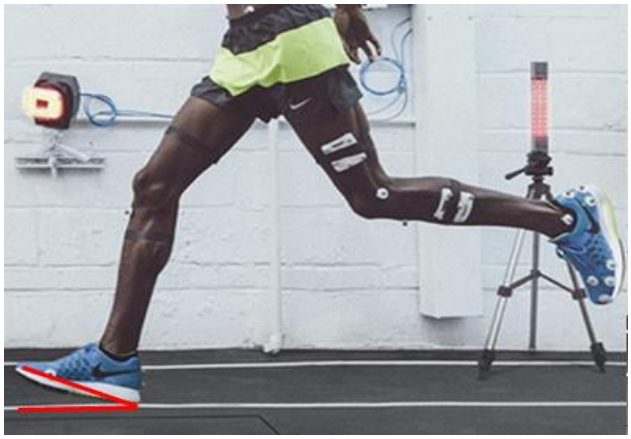
-Hips act in keeping good posture and are your center of gravity. If you allow your torso to lean too far forward and hunch over your pelvis will therefore tilt forward which can put pressure on your lower back and throw the rest of your lower body out of alignment.

-Striding: avoid over-striding.



Comparison of self to an elite performer

I looked at myself and compared my running style to a professional athlete, although the elite athlete had access to professional and technical equipment to analyse their running style. Whereas I only had access of pictures to analyse from.



I learnt I need to concentrate on my alignment of my body starting with my hips, keeping my torso upright and driving my front leg and knee forward and higher. Also increasing my stride length which furthers the extension of my back leg, but I don't want to over extend resulting injury. Improving my PB, as my stride length will increase, and I'll run faster.

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First section bibliogrpahy

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Performance Development Programme - Athletics 5000m

Introduction

My performance development programme is focused on developing and improving aerobic endurance as it's the most important component for my sport.

SMARTER targets

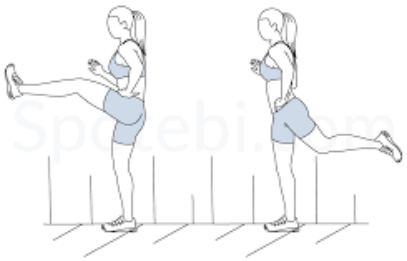
Specific: designing a training programme to suit a certain aspect of your sport.
Measurable: training programme is designed so you can collect data which can be analyzed and presented.
Achievable: training programme is designed so are physically capable of achieving your set goal.
Realistic: is designed so can achieve the results your intended.
Time-bound: is designed to help you improve to a set ability within a certain amount of time.
Exciting: keeping training exciting so that it doesn't become boring or tedious.
Recorded: is designed so you can collect results in order to look at progress.

I'll create a training programme to relate to my capability and needs, to make it achievable goal and it specific to me.

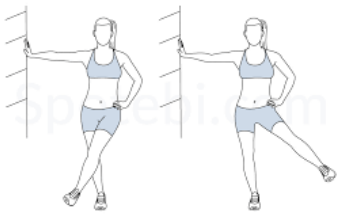
Typical, weekly training plan

Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	3 mi run	5 x 400	Rest or easy run	30 min tempo	Rest	4 mi fast	60 min run
2	3 mi run	8 x 200	Rest or easy run	30 min tempo	Rest	4 mi fast	65 min run
3	3 mi run	6 x 400	Rest or easy run	35 min tempo	Rest	5 mi fast	70 min run
4	3 mi run	9 x 200	Rest or easy run	35 min tempo	Rest or easy run	Rest	**5K Test**
5	3 mi run	7 x 400	Rest or easy run	40 min tempo	Rest	5 mi fast	75 min run
6	3 mi run	10 x 200	Rest or easy run	40 min tempo	Rest	6 mi fast	85 min run
7	3 mi run	8 x 400	Rest or easy run	45 min tempo	Rest	6 mi fast	90 min run
8	2 mi run	6 x 200	30 min tempo	Rest or easy run	Rest	Rest	**5K Race**

Forward leg swings



Sideways leg swings



Walking lunges

Sumo squats

Principles of training

Specificity-

"The type of training you do is specific to you and your sport" [2].

Progressive overload-
"Training activities that are harder, longer and more intense to an athlete's normal session".

Overtraining-
"When the intensity of the training or length is increased to extreme levels". (See typical week).

Variance-
"Varying the method of training you do between each session to reduce tedium" as training causes boredom because of lack of variety.

Individual needs-
"All athletes are different therefore sessions need to be tailored to the needs of the athlete, taking in consideration for example their age and gender".

Reversibility-
If you stop training for a period of time fitness can decrease therefore improvement is slower. I'll not over-train and injure myself nor will I take lengthy breaks between training sessions.

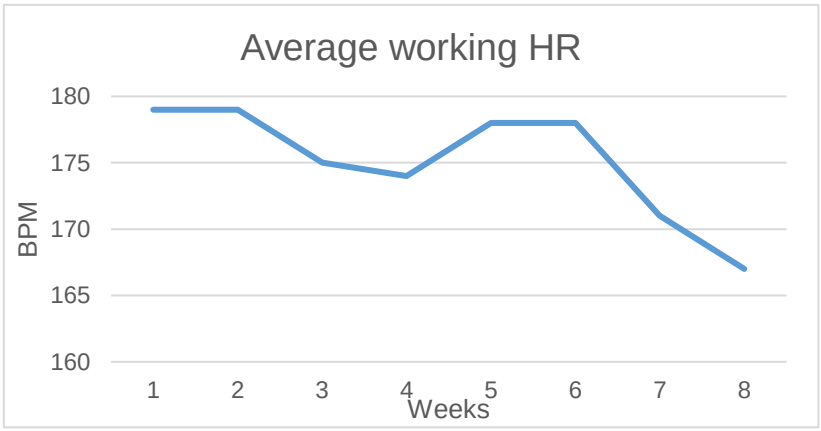
FITT principle…
-Frequency- "how often we train". [2]
-Intensity-"how hard we train". [2]
-Time- "the duration you train for". [2]
-Type- "the type of training we use, e.g. duration". [2]

Methods of training - Continuous training and fartlek.
I chose continuous as my method of training "Continuous training is a form of exercise that is performed at one intensity throughout and doesn't involve any rest periods. It typically involves aerobic activities such as running, biking, swimming and rowing." [26] Including fartlek training to allow for variance, reducing boredom and tedium.

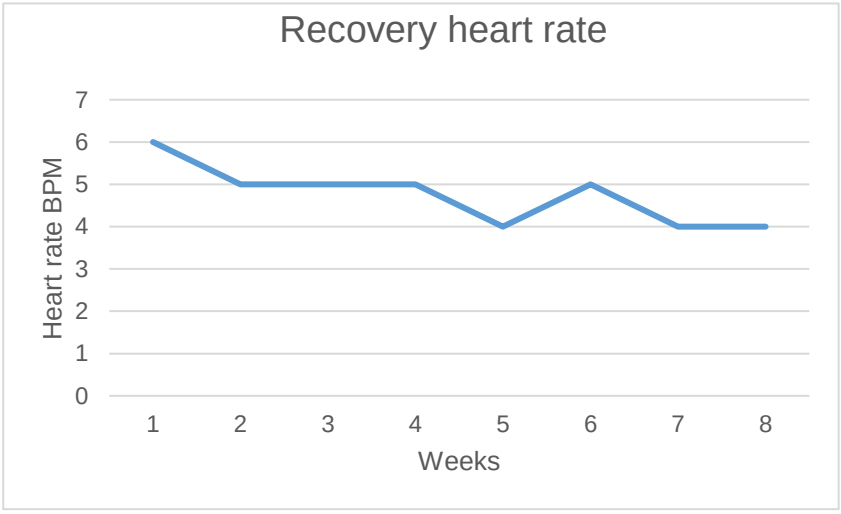
Review and evaluation

Test	Results before programme	Results after programme
12-minute cooper run	3100 meters	3200 meters
Body weight squat test	43+	66+

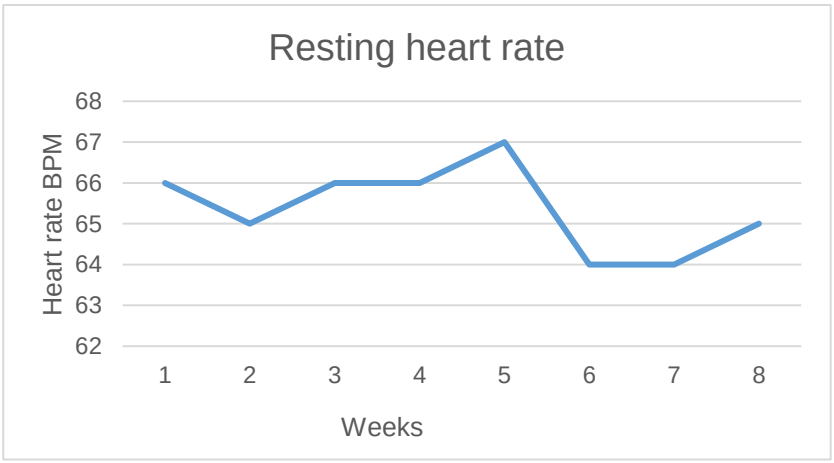
If I was to run a 5k at the pace I completed the 12-minute cooper run it would take me 18.8 minutes, I cannot keep this pace up for an extra 2k. My PB for 5k is now 20.39, when before the training it was 20:57, therefore I managed to knock off 18 seconds, 3 more seconds than I hoped.



This graph shows my heart rate for a 5k run. My heart rate is at a steep increase throughout the training session as I held a constant intensity and I found it harder with my max heart rate of 196 bpm.



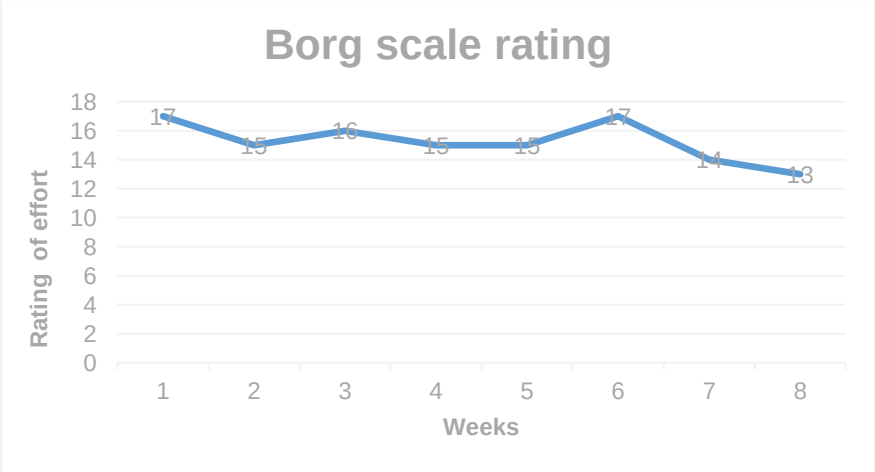
Recovery heart rate is overall decreases during the weeks. Training has consisted of runs over 20 mins throughout the weeks, not just those that are recorded.



This graph doesn't clearly show a decline in my resting heart rate, my average resting heart rate slowly decreases. The peak at 5 weeks may be due to fatigue from the previous day or due to an anticipatory rise as my training that week was a race. Overall improvement.

Rating of Perceived Exertion
Borg RPE Scale

6 7 8	Very, very light	How you feel when lying in bed or sitting in a chair relaxed. Little or no effort.
9 10 11	Very light Fairly light	
12 13 14	Somewhat hard	Target range: How you should feel with exercise or activity.
15 16	Hard	
17 18	Very hard	How you felt with the hardest work you have ever done.
19 20	Very, very hard Maximum exertion	Don't work this hard!



This graph shows the effort I felt I worked during each session. There is an overall decrease as I got fitter and began to find the intensity easier, getting used to the distances. There is a spike at week five as I completed a hard/intense fartlek session which I wasn't perhaps used to compared to a longer run.

Overall evaluation

At the start of my training programme I set out to improve my aerobic endurance and therefore resulting in my PB improving by 18 seconds, from 20:57 to 20:39 minutes, this is a 1.43% increase, in terms of running is a significant improvement.

Adaptations I have experienced are cardiac hypertrophy, increasing cardiac output, therefore more blood is pumped to my working muscles and my heart isn't having to work as hard, but oxygen is being supplied to the working muscles. This enables me to work for longer at a higher intensity without reaching fatigue as quickly.

Appendix

- Vo2 max test:

Required resources;
-oxygen and carbon dioxide analyzers
-ergometer
-heart rate monitor
-stopwatch
The exercise workloads are selected to gradually progress in increments from moderate to maximal intensity. Oxygen uptake is calculated from measures of ventilation and the oxygen and carbon dioxide in the expired air, and the maximal level is determined at or near test completion [9] Any sport in which aerobic endurance is a component, such as distance runners, triathlon and cycling.
My result, in my results I got above average for my age, as I had a high Vo2 max

Maximal oxygen uptake norms for women (ml/kg/min)

	Age (years)
rating	18-25
excellent	> 56
good	47-56
above average	42-46
average	38-41
below average	33-37
poor	28-32
very poor	< 28

- Body weight squat test: Stand in front of a chair or bench with your feet at shoulder's width apart, facing away from it. Place your hands on your hips. Squat down and lightly touch the chair before standing back up. Write down how many squats you can do until you can't carry on. [1]
  This test focused on your both your hamstring group and your quadriceps group, when going down into the squat position your quadriceps group, (vastus lateralis, rectus femoris and vastus mefialis) contract therefore allowing you to hold the squat position, and flexion at the patella. When coming up from the squat your hamstring group (semitendinosus, biceps femoris and semimembranosus) relax and your hamstring contract, therefore elevating you to a standing position, patella extends. [2]

  Normative data= age 18-25

Rating…	no. of squats
Excellent	43+
Good	37-43
Above average	33-36
Below average	29-32
Poor	18-24
Very poor	18-

  I scored excellent in the body weight squat test by scoring 89.

- Skin fold measurement: determines body fat composition and can be use in 3-9 places on the body, the tester pinches the skin at the appropriate site to raise a double layer of skin and the underlying adipose tissue, but not the muscle. The calipers are then applied 1 cm below and at right angles to the pinch, and a reading in millimeters (mm) taken two seconds later. The mean of two measurements should be taken. [3]

Female	Excellent	good	Below average	poor	very poor
Normal	70–90	91–100	101–120	121–150	150+
Athletic	50–70	71–85	86–110	111–130	130+

[5]

Performance and recording

Fitness tests

To analyze whether I have improved I'll use fitness tests, before the 10-week programme, mid-way at 5 weeks and at the end of the programme to see if the programme was effective and if it worked.
The two tests I'll use is the 12- minute cooper run and the body weight squat test. These both measure aerobic and muscular endurance, which are both the crucial components needed for 5000m.

Fitness testing before 10-week programme

(see protocol in appendix)

- 12- minute cooper run- I rated above average for my age group, female aged 20.
  My result was 2650m, whereas an excellence rating was above 3700m

- Body weight squat test- I got a score of 52 which was excellent for 18-20 years.

Week 1- continuous, aerobic training

12.06.18

Warm up

- 3-minute pulse raiser (jog) at 50% effort
- Dynamic stretches: lunges on the move, cherry picking and open a close the gate
- Static stretches (focusing on leg muscle groups): hamstring, quadriceps and gastrocnemius stretches.

Main session

3k run= 1.86 miles
-across different terrain both on fields and the road
-60% effort

Results

Overall time- 13.05 minutes
Avg mile time- 7.10

RHR- 66bpm
WHR- 179bpm max HR- 198bpm

Borg scale rating-17

Recovery HR (minutes) bpm
1 min- 134
2 min-116
3 min-89
4 min-74
5 min- 69
6 min- 66

Cool down

- 2-minute slow jog 30-40 % effort
- Static stretches- focus on muscle groups in legs (hamstring & quadriceps)

Overall session duration= 30 minutes

Week 2- continuous, aerobic training

19.06.18

Warm up

- 2-minute jog
- Dynamic stretches: jumping lunges, open and close the gate, cherry picking and ankle roles
- Static stretches

Main session

- 5k run
- Up to 60-65%maximal effort
- On dry roads

Results

Overall time-22.36 minutes
Avg mile pace- 7.05/mi

RHR-65bpm
Avg WHR- 179bpm max HR-199bpm

Borg scale rating=15

Recovery HR (minutes) bpm
1 min-132
2 min-116
3 min-87
4 min-75
5 min-65

Cool down

- 2-minute slow jog 30-40 % effort
- Static stretches- focus on muscle groups in legs (hamstring & quadriceps)

Overall session duration- 25 minutes

Week 3- fartlek training

26.06.18

Warm up

- 2-minute jog
- Dynamic stretches: jumping lunges, open and close the gate, cherry picking and ankle roles
- Static stretches

Main session

- 10-minute warmup at an easy pace
- 1 minute on (fast pace), 2 minutes off (easy), 2 minutes on, 1 minute off
- Repeat the fartlek set 3 to 4 times
- 10-minute cool down at an easy pace

Results

Overall session time= 40 minutes

RHR-66bpm

Avg WHR- 175bpm max HR-198bpm

Borg scale rating=16

Recovery HR (minutes) bpm
1 min-134
2 min-117
3 min-87
4 min-74
5 min-67

Cool down

- 2-minute slow jog 30-40 % effort
- Static stretches- focus on muscle groups in legs (hamstring & quadriceps)

Session duration= 40 minutes

Week 4-continuous, aerobic training

03.07.18

Warm up

- 3-minute pulse raiser (jog) at 50% effort
- Dynamic stretches: lunges on the move, cherry picking and open a close the gate
- Static stretches (focusing on leg muscle groups): hamstring, quadriceps and gastrocnemius stretches.

Main session

4k run (2.45 miles), off road around a school field.

Results

Overall time= 21.56 minutes
Avg mile pace= 7.12/mi
Avg k pace= 4.26
WHR= 174bpm
RHR =66bpm
Max HR=198bpm
Borg scale-15

Recovery HR (minutes) bpm
1 min-135
2 min-112
3 min-88
4 min-72
5 min-67

Cool down

- 2-minute slow jog 30-40 % effort
- Static stretches- focus on muscle groups in legs (hamstring & quadriceps)

Overall session time= 35 minutes

Week 5- continuous aerobic training
10.07.18

Warm up

- 3-4-minute pulse raiser at low effort
- Dynamic stretches: lunges, gastrocnemius, quadriceps and hamstring stretches.
- Statics stretches- again focus on muscles in the leg, e.g. leg hold.

Main session

- 6k run, around country lanes and across local footpaths, however fairly flat terrain

Results

Overall time=21.57 minutes
Avg k pace= 4.33
WHR= 178bpm
RHR=67bpm
Max HR= 186bpm
Borg scale= 15

Recovery HR (minutes) bpm
1 min- 150
2 min- 120
3 min- 85
4 min- 68
5 min- 65

Cool down

- 2-minute slow jog minimal effort
- Static stretches, for me concentrating on leg muscle groups

Week 6- fartlek training

17.07.18

Warm up

- 4-minute pulse raiser, slow jog.
- Dynamic stretches, e.g. cherry picking and high knees
- Static stretches, focusing on leg muscles

Main session

- 7x400 m runs.
- 2 minutes rest between each 400m

Results

Overall time= 25 minutes

Avg WHR per 400m= 178bpm

RHR= 64bpm

Max HR= 181bpm (during last 400m)

400m split times (seconds)

1) 65s
2) 67s
3) 72s
4) 65s
5) 71s
6) 73s
7) 75s

Borg scale=17

Recovery HR (minutes) bpm

1 min-176
2 min- 135
3 min- 82
4 min- 74
5 min- 66

Cool down

- 2- minutes jog, minimal effort
- Static stretches

Week 7- aerobic training

Warm up

- 1k slow jog, low effort
- Dynamic stretches: lunges, gastrocnemius, quadriceps and hamstring stretch
- Statics stretches- again focus on muscles in the leg, e.g. leg hold.

Main session

- 35 min tempo run. “A tempo run consists of a 10-15-minute easy warm-up jog, followed by a 3-6 mile run at about your 10k pace.” [35]

Results

Overall time= 35 minutes
Avg WHR= 171bpm
RHR=64bpm
Max HR= 175bpm

Borg scale=14

Recovery HR (minutes) bpm
1 min- 175
2 min- 135
3 min- 89
4 min- 68

Cool down

- 5-minute cool down, minimal effort
- Static stretches- focus on muscle groups in legs (hamstring & quadriceps)

Week 8- aerobic training

Warm up

- 4-minute pulse raiser
- dynamic stretches: cherry picking, walking lunges etc.
- static stretches: again, focusing on leg muscles groups

Main session

- 5k run on country roads. Includes mild hills.

Results

Overall time- 21:14 minutes
Avg WHR- 167 bpm
RHR- 65bpm
Max HR- 174bpm

Borg scale=13

Recovery HR (minutes) bpm
1 min- 160
2 min- 122
3 min- 79
4 min- 67

Cool down

- 2- minutes jog, minimal effort
- Static stretches

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