

GCSE PE PEP

Name: [REDACTED]

Candidate number: [REDACTED]

Centre: [REDACTED]

Aim: To improve the efficiency of the start and turns in my 100m backstroke by improving my leg power.

Accumulative word count (excluding titles, training logs, graphs, tables and pictures etc): **1536**

Introduction

My PB in the 200m backstroke event is 2 minutes 20 seconds. The event requires a combination of anaerobic and aerobic energy systems (2). More specifically, swimmers require elements of power, speed, and endurance to reach their performance potential.

Aerobic endurance allows a swimmer to sustain long periods of aerobic activity in training and in a competitive situation. Furthermore, speed is important for swimmers as it is the ability to break through a natural barrier that is at the core of the sport (3). Power is also an essential component in order to create an explosive start and turn. It is important as the greater the force the swimmer's muscles can exert on the water, the faster they can swim (4).

The three most important components of fitness for a 200m backstroke swimmer are; aerobic endurance, speed and power.

Performance Analysis

To assess the impact of my fitness on my performance I will conduct a notational analysis in order to make a comparison to an elite performer.

My performance:

Date: 03/02/19

Venue: Crystal Palace National sports centre

Time: 2.27.70 (short course) 2.29.97 (long course)

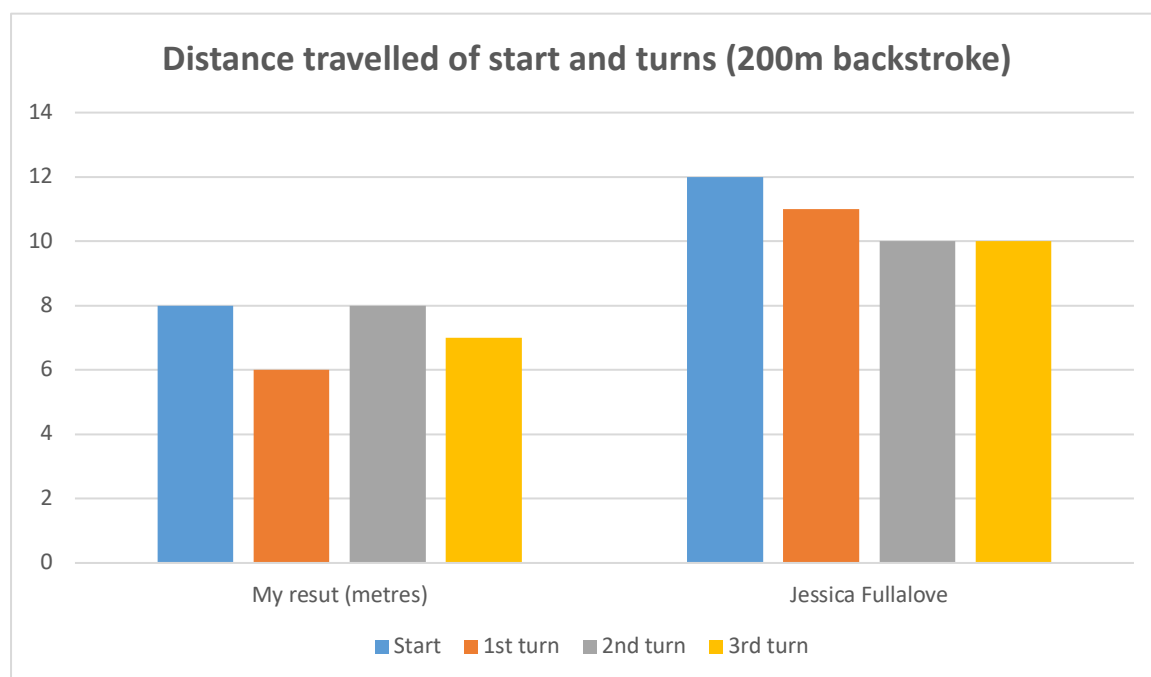
Elite athlete notational results: Jessica Fullalove (5)

Date: 19/04/19

Venue: Glasgow

Time: 2.09.74 (long course) 2.07.00 (short course)

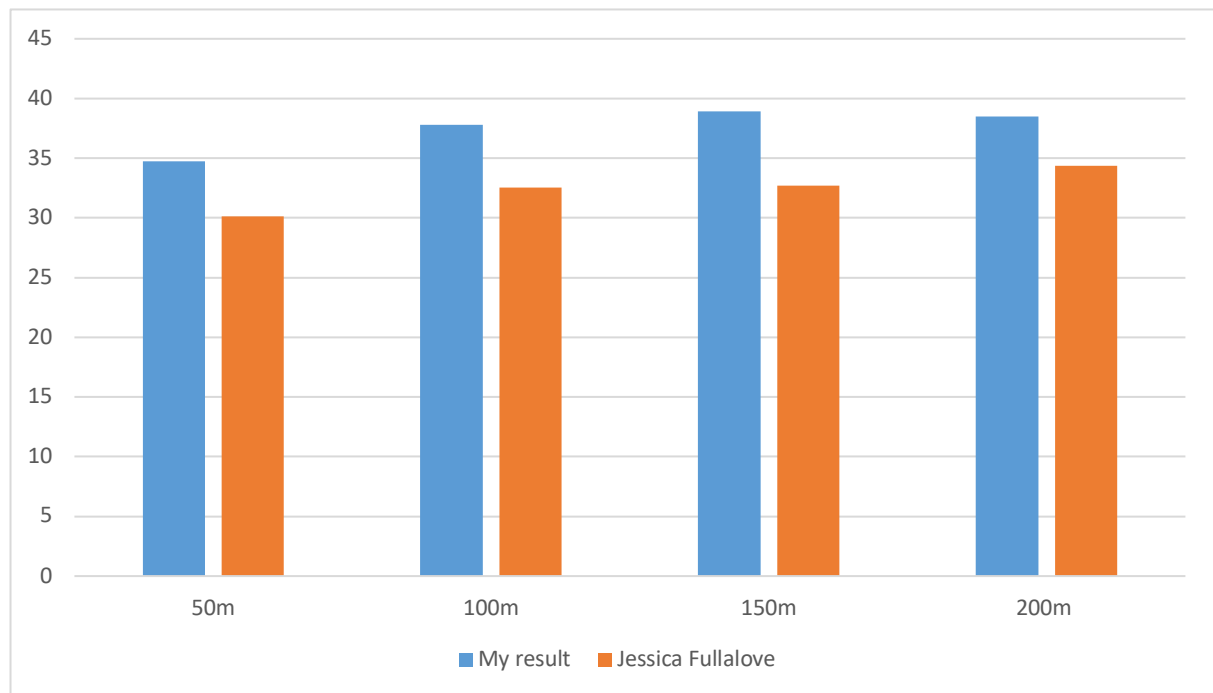
Turns	Start	1 st turn	2 nd turn	3 rd turn
My result	8m	6m	8m	7m
Elite Performer	12m	11m	10m	10m



Throughout the race there is a significant difference between the distance travelled concerning starts and turns in comparison to the elite performer. Her speed of rotation and explosive power on the push-off from the wall allows her to make better progress during this aspect of the race, something that I need to improve in order to increase my time.

Time taken for each lap (200m):

	50m	100m	150m	200m
My results	34.76	1.12.58 (37.82)	1.51.49 (38.91)	2.29.97 (38.48)
Elite Performer	30.14	1.02.66 (32.52)	1.35.38 (32.72)	2.09.74 (34.36)

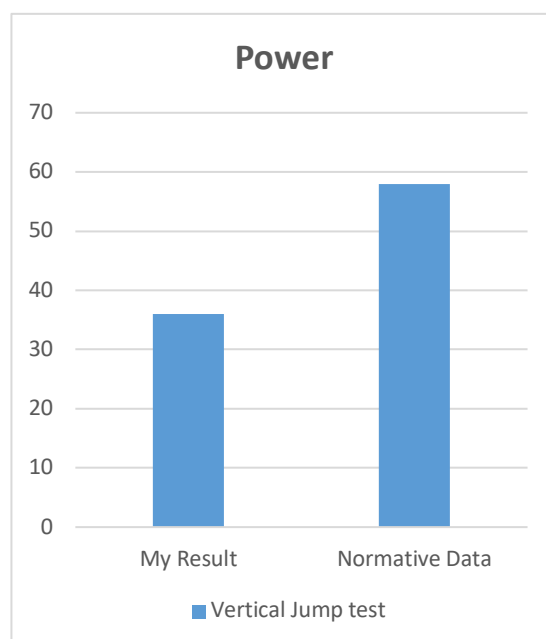
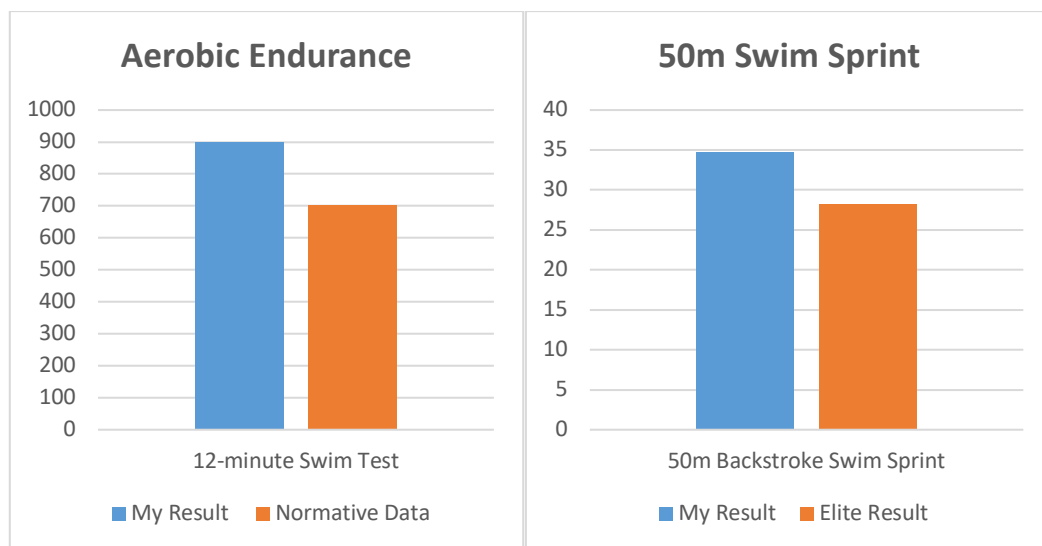


There is a greater discrepancy between the first lengths and my last lengths when compared to the elite swimmer. Her times shown are all below 35 whereas for mine all but one is above 35 seconds. This could be attributed to technique and speed of stroke; however, it could also be due to a lack of power at the start and with the turns. I will analyse the fitness elements in the next section to gain a better understanding.

Fitness Analysis

From my initial analysis of the most important components of fitness required for the 200m backstroke event, I will conduct a fitness test battery based on the three tests associated with aerobic endurance, speed and power.

Test	Component of fitness	Result	Normative Data	Excellent
12-minute swim test	Aerobic Endurance	900m	Excellent	>700m
50m swim sprint	Speed	34.76 secs	Above Average	28.3 secs
Vertical Jump Test	Power	36cm	Average	58cm



After analysing my results, power has been identified as the main area that needs improving in order to reach a more elite level. There is a clear weakness with regards to my lower body power and focussing on developing explosive power from my starts and turns will lead to an increase in speed.

Possessing high levels of power allows swimmers to improve their reaction at the start, push off out of each turn and with the rotation during the turn. By improving power, it can improve starts and turns by 10.5% and 20.5% respectively (1).

Aim: To improve the efficiency of the start and turns in my 200m backstroke by improving my leg power.

SMART targets

Specific: improving the power produced by my legs will potentially increase the distance of the starts, turns and the underwater propulsion, overall having a positive effect on improving my performance.

The specific targets in order to meet my overall aim include:

1. Improve vertical jump score by **10%**
2. **Initial distance travelled underwater off my start** aim of increasing by **40%** off my initial distance of 8m, aim of travelling 11.2m off my start.
3. **Distance travelled off the turns** increasing by **30%**.

Measurable

In order to monitor and measure progress throughout the PEP I will use the vertical jump test mid- and post-PEP. The results mid PEP will be used to re-calculate the appropriate intensities to make further progress.

I will also measure my progress by analysing the impact of the programme on performance through a notational analysis.

Agreed: My coach and I have agreed together that through my notational results and video evidence that power I expel from my legs is the weakest part of my performance. We agreed that improving the effectiveness of my undulation and power off the wall at the starts, turns and finishes will improve my performance overall.

Realistic: By applying the correct principles of training through appropriate intensity levels (working at 70% up to 85% 1RM), progressive overload and specificity I can achieve my aim at the end of the 6-week period. I will be using:

1. Plyometric training (specific)
2. Swim training (non-specific) maintaining fitness alongside improving my leg power.

Time-bound: I have set myself a target of a 6-week training period to achieve my aim. My training will be broken into two mesocycles (2 x 3-week cycles) with a transition phase where fitness tests will be completed. The tests will also occur at the end of the PEP.

Methods of training

Using plyometric exercises, it encourages the muscle to achieve maximal force rapidly and therefore helping to increase explosive reactive power through a range of motion (11).

Plyometric training is effective for developing power when planned effectively (9); but can also help reduce over-use injuries which is important due to the repetitive nature of swimming. Plyometric training combines speed and strength to produce power and acceleration which can be seen when launching off the block, exploding off the wall, during a turn and even executing the power phase of the stroke (10).

Principles of training

Frequency: During my PEP I will be completing plyometric training twice a week alongside my non-power specific training at my swim club 6 times a week, although I will apply progressive overload and look to use plyometric three times per week in the 2nd 3-week period. Alongside my training I will have rest days to allow for adaptations to occur.

Intensity: To improve my power my training needs to be gradually improved to allow for an increase in demand from my body allowing for adaptations to be made. Initial intensity will be **70% 1RM** with hoping to progress to **85% 1RM** by the end of the PEP. I will also be applying progressive overload by increasing the height of the boxes I jump. The height in the boxes will begin at 15 inches and look towards achieving 18 inches.

Time: My plyometric training sessions will last for about 30-45 minutes, at most 3 sessions a week to allow for recovery after each session (12). My swimming sessions lasting an hour to two-hour sessions.

Type: In my PEP, I will complete exercises including; squat jumps, bench or box jumps, advanced burpees, forward hops, frog hops, lateral lunge, mini-band external rotation and squat jumps with weights (6), (8). By doing these exercises it activates the fast twitch muscles fibres which produce force quickly and efficiently (7).

Physical Activity Readiness Questionnaire

Name	██████████
Gender	Female
Age	16
Weight (kg/st.)	
Height (cm/ft)	5"7
Medical Info	Asthmatic
Past Injuries	Rotator cuff injury causes issues with my shoulder sometimes.
Smoke (Y/N)	N
Activities Currently Undertaken	Swimmer in which I swim 6 times a week with 1 day of land training as well as undertaking netball, rounder's, athletics, cricket afterschool.
Frequency of exercise/training	I train 8 times a week at Maidstone Leisure Centre with Maidstone swimming club with one land training session and 3 gym sets.
Additional Comments about health and fitness	

PEP Training Recording Sheets

Week: 1

Duration of Session: 45mins

Session 1: 22/04/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15 mins warm up	N/A	Speed: 8.0	1min
Lateral bound	3x15	N/A	N/A	1mins 3 before next activity
Squat jumps with streamlined arms	3x15	N/A	N/A	1mins 3 before next activity
Box jumps 36cm	3x10	N/A	N/A	1mins 3 before next activity
Advanced burpees	3x15	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed:5.0	N/A

Session 2: 24/04/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15mins warm up	N/A	Speed: 8.0	1 min
Lateral lunge	3x15	N/A	N/A	1mins 3 before next activity
Plyo reverse step	3x15	N/A	N/A	1mins 3 before next activity
Frog jumps	3x15	N/A	N/A	1mins 3 before next activity
Squat thrusters	3x15	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

Week: 2

Duration of Session: 45mins

Session 1: 29/04/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15 mins warm up	N/A	Speed: 8.0	1min
Lateral bounds	5x10	N/A	N/A	1mins 3 before next activity
Squat jumps	5x10	N/A	N/A	1mins 3 before next activity
Box jumps	4x10	N/A	N/A	1mins 3 before next activity
Advanced burpees	5x10	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

Session 2: 01/05/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15mins warm up	N/A	Speed: 8.0	1 min
Lateral lunge	5x10	N/A	N/A	1mins 3 before next activity
Plyo reverse step	5x10	N/A	N/A	1mins 3 before next activity
Frog jumps	5x10	N/A	N/A	1mins 3 before next activity
Squat thruster	5x10	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

Week: 3

Duration of Session: 45mins

Session 1: 06/05/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15 mins warm up	N/A	Speed: 8.0	1min
Lateral bounds	4x15	N/A	N/A	1mins 3 before next activity
Squat jumps	4x15	N/A	N/A	1mins 3 before next activity
Box jumps 40cm	4x10	N/A	N/A	1mins 3 before next activity
Advanced burpees	4x15	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

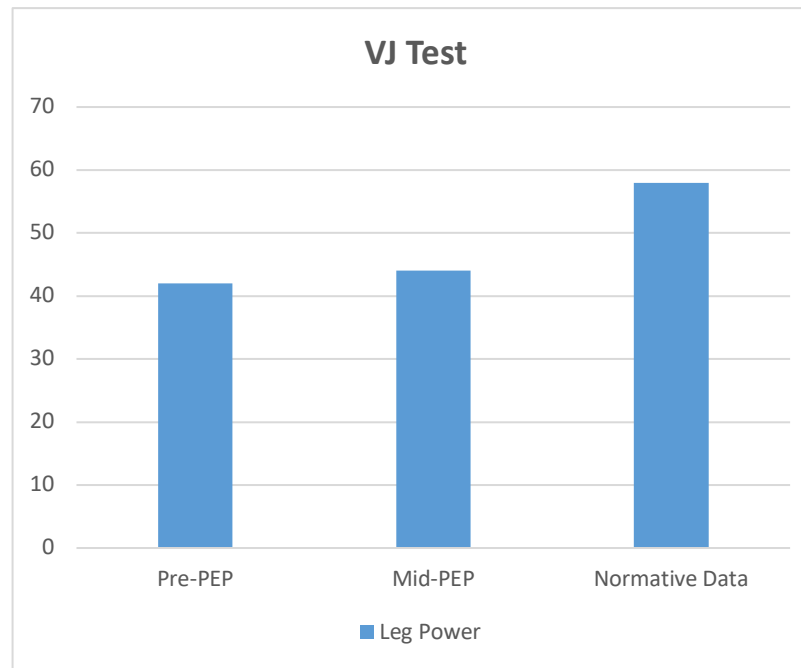
Session 2: 08/05/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15mins warm up	N/A	Speed: 8.0	1 min
Lateral lunge	4x15	N/A	N/A	1mins 3 before next activity
Reverse lunge with knee	4x15	N/A	N/A	1mins 3 before next activity
Frog jumps	4x15	N/A	N/A	1mins 3 before next activity
Squat thruster	4x15	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

Mid-PEP Testing

Vertical jump test

Vertical Jump Test Data:

Vertical Jump Test	Score
Pre-PEP	42cm
Mid-week training	44cm
Normative Data (Excellent)	58cm



Date: 13/05/19

Week: 4

Duration of Session: 45mins

Session 1: 18/05/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15 mins warm up	N/A	Speed: 8.0	1min
Squat jumps with medicine ball 8kg	5x10	N/A	N/A	1mins 3 before next activity
Box jumps 42cm	5x10	N/A	N/A	1mins 3 before next activity
Advanced burpees	4x15	N/A	N/A	1mins 3 before next activity
Squat thruster	4x15	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

Session 2: 20/05/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15mins warm up	N/A	Speed: 8.0	1 min
Burpee with knee tuck	4x15	N/A	N/A	1mins 3 before next activity
Single leg dead lift with jump	4x10	N/A	N/A	1mins 3 before next activity
Full body plyo push up	4x10	N/A	N/A	1mins 3 before next activity
Long jump	4x10	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

Session 3: 22/05/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15mins warm up	N/A	Speed: 8.0	1 min
Static stretching	N/A	N/A	N/A	1 min then begin next set
Plyo reverse step with knee	4x15	N/A	N/A	1mins 3 before next activity
Box drills	15x10	N/A	N/A	1mins 3 before next activity
Mini band external rotation	4x15	N/A	N/A	1mins 3 before next activity
Lateral lunge	4x15	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A
Static stretching	N/A	N/A	N/A	N/A

Week: 5

Duration of Session: 45mins

Session 1: 25/05/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15 mins warm up	N/A	Speed: 8.0	1min
Squat jump with medicine ball 10kg	4x15	N/A	N/A	2mins 3 before next activity
Box jumps 42cm	4x15	N/A	N/A	2mins 3 before next activity
Advanced burpees	4x15	N/A	N/A	2mins 3 before next activity
Squat thrusters	4x5	N/A	N/A	2mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

Session 2: 27/05/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15mins warm up	N/A	Speed: 8.0	1 min
Burpee with knee tuck	4x15	N/A	N/A	2mins 3 before next activity
Single dead lift with jump	4x15	N/A	N/A	2mins 3 before next activity
Full body plyo push up	4x15	N/A	N/A	2mins 3 before next activity
Long jump	4x15	N/A	N/A	2mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

Session 3: 29/05/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15mins warm up	N/A	Speed: 8.0	1 min
Plyo reverse step with knee	4x15	N/A	N/A	2mins 3 before next activity
Box drills	15x10	N/A	N/A	2mins 3 before next activity
Mini band external rotation	4x10	N/A	N/A	2mins 3 before next activity
Lateral lunge	4x10	N/A	N/A	2mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

Week: 6

Duration of Session: 45mins

Session 1: 01/06/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15 mins warm up	N/A	Speed: 8.0	1min
Squat jumps with medicine ball 10kg	4x15	N/A	N/A	1mins 3 before next activity
Box jumps 43cm	4x15	N/A	N/A	1mins 3 before next activity
Advanced burpees	4x15	N/A	N/A	1mins 3 before next activity
Squat thruster	4x15	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed: 5.0	N/A

Session 2: 03/06/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15mins warm up	N/A	Speed:8.0	1 min
Burpee with knee tuck	4x15	N/A	N/A	1mins 3 before next activity
Single leg dead lift with jump	4x15	N/A	N/A	1mins 3 before next activity
Full body plyo push up	4x15	N/A	N/A	1mins 3 before next activity
Long jump	4x15	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed:5.0	N/A

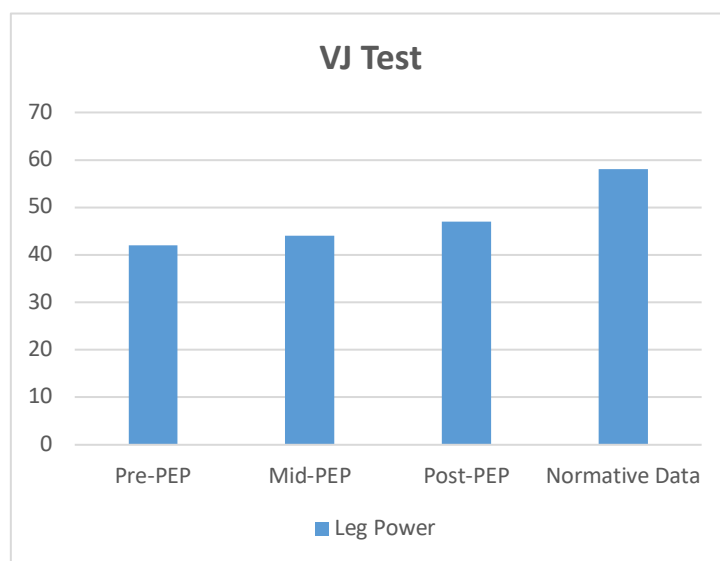
Session 3: 05/06/19				
Exercise	Volume (sets x reps)	Load (kg)	Intensity	Rest (between sets)
Running on treadmill	15mins warm up	N/A	Speed: 8.0	1 min
Plyo reverse step	4x15	N/A	N/A	1mins 3 before next activity
Box drills	15x10	N/A	N/A	1mins 3 before next activity
Mini band external rotation	5x10	N/A	N/A	1mins 3 before next activity
Lateral lunge	5x10	N/A	N/A	1mins 3 before next activity
Running on treadmill	15mins cool down	N/A	Speed:5.0	N/A
Static stretching	N/A	N/A	N/A	N/A

Evaluation

Evaluation of Fitness

Vertical Jump Test Data:

Vertical Jump Test	Score
Pre-PEP	42cm
Mid-week training	44cm
Post- training	47cm
Normative Data (Excellent)	58cm



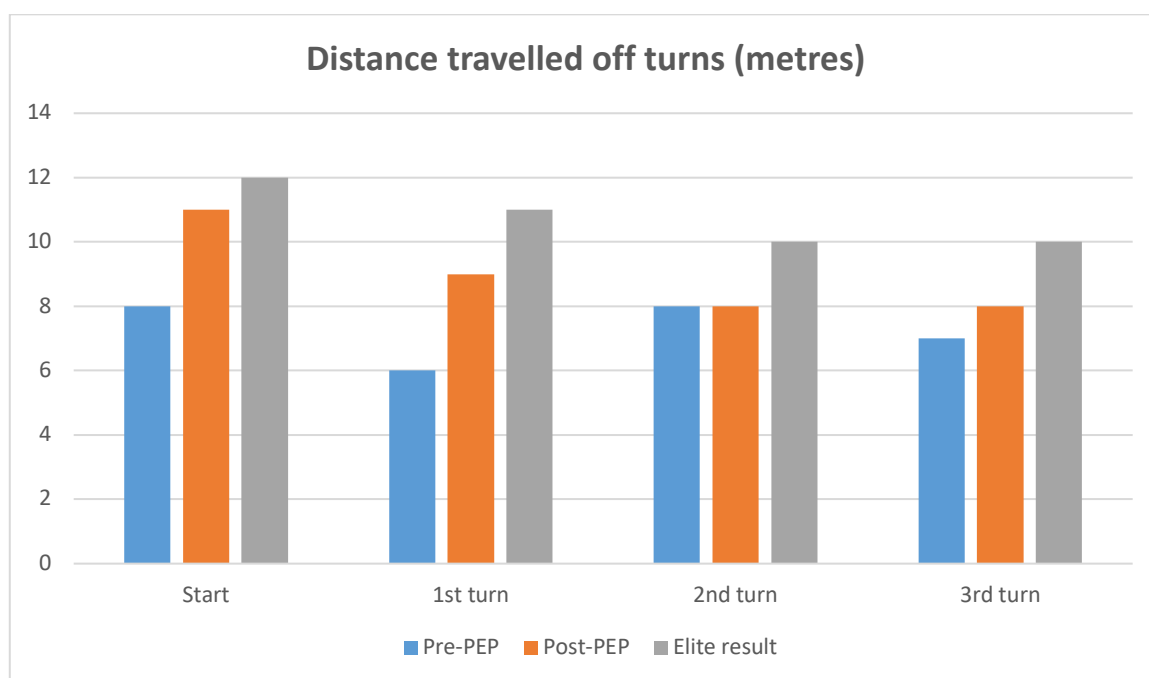
As illustrated in the graph above, my power **increased by 12%** over the 6 weeks, meaning that **I achieved my target of 10%**. Specific adaptations have probably occurred due to the effects of plyometric training that has helped to increase my lower body power, which could include: the development and efficiency of my neuromuscular system which helps to achieve this explosive reactive power off the block, starts and turns. Another possible adaptation could be activating motor units successfully and muscular activation from coordinated movements which in turn improved muscular contraction force (11).

In the study from Bishop (2009) it also suggested that by improving the reactive power the speed from release to water had an impact in relation to each other, which is evident with the results achieved (14).

Performance Analysis

Distanced travelled from the start/turn:

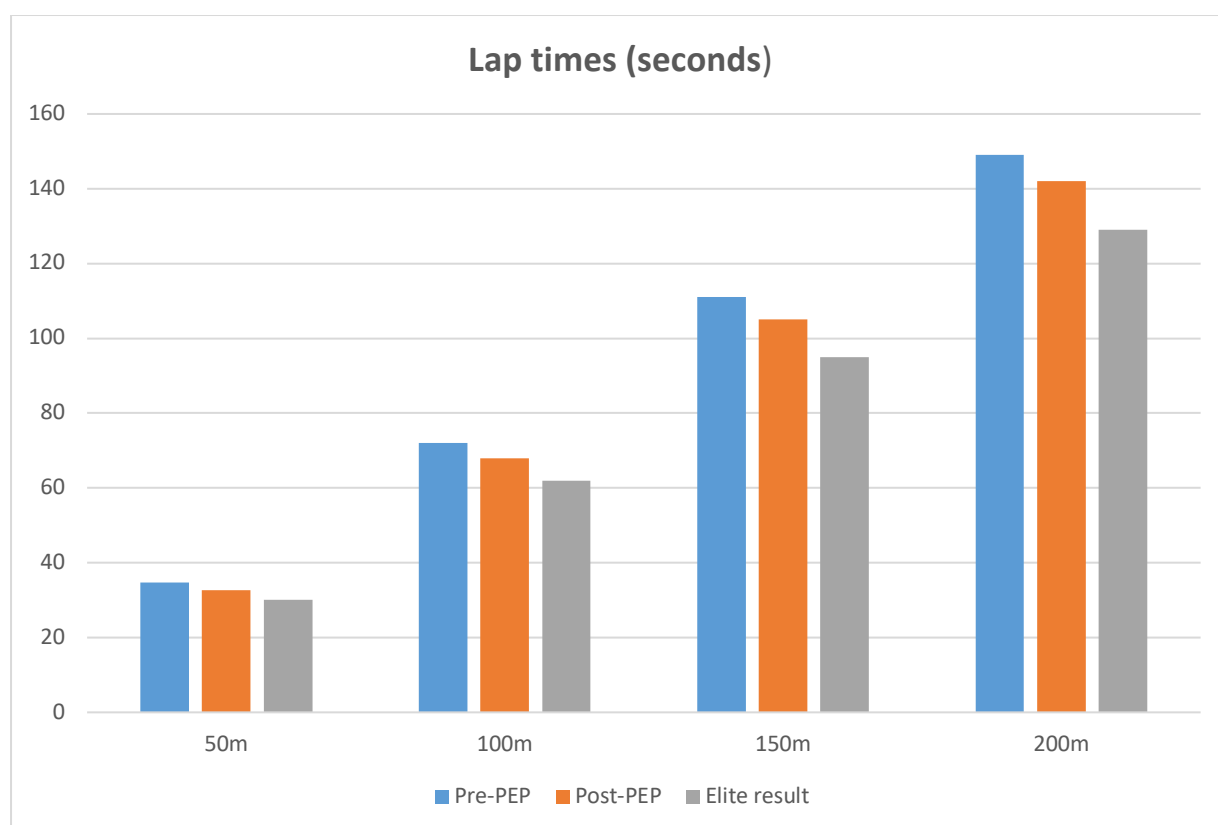
	Start	1 st turn	2 nd turn	3 rd turn
Pre-PEP	8m	6m	8m	7m
Post-PEP	11m	9m	8m	8m
Elite performer	12m	11m	10m	10m



It is evident that there is an improvement in my power from my competitive races as illustrated in the notational analysis above. Although I increased the distanced covered **off the start by 38%**, I did not quite meet **my target of 40%**. However, I also set a target of improving the distanced achieved on the turn, especially the first turn and this was **improved by 50% (target was 30%)**. The inclusion of plyometric training specific to the movements involved in the start and turns has definitely allowed for faster recruitment of type IIx fibres, although the rate of improvement for the 2nd and 3rd turns was not so significant. This could be an indication of decreasing aerobic endurance and not being able to recovery quick enough been laps, therefore reducing power output on these turns later in the race.

Lap Times:

	50m	100m	150m	200m
Pre-PEP	34.76	1.12.58 (37.82)	1.51.49 (38.91)	2.29.97 (38.48)
Post-PEP	32.70	1.08.32 (35.62)	1.45.25 (36.93)	2.22.67 (37.42)
Elite Performer	30.14	1.02.66 (32.52)	1.35.38 (32.72)	2.09.74 (34.36)



To specifically improve my power I used **plyometric training**, which ultimately improved my speed as well. This led to an improvement in my performance by decreasing my time swum for the 200m backstroke, not just the distance travelled off the wall.

However, in relation to recovery, I also believe I **over trained** with the inclusion of three plyometric training days in the 2nd 3-week training period. It was too much considering the specific swimming training I was doing as well, and this could have been a factor in not improving the distance on turns later in the race. After reviewing my **training logs**, you can see that I only had 2 days rest between plyometric sessions throughout the PEP. This recovery period is not long enough considering the stress/load on my muscles (especially the quadriceps and gastrocnemius) during eccentric movements. I also feel that the rest days could have been altered to recovery days, because the sessions completed in my programme caused microtears in response to the stress. This means that the microtears didn't have a realistic time period to recover which I found resulted in many days suffering with **delayed onset of muscle soreness (DOMS)**. Also, by completing active recovery instead of rest, it means that the blood lactate levels produced by training are significantly reduced

as well, helping to speed up recovery as it focuses on movements that allow blood to move and decrease residual fatigue in the muscles (15).

In terms of **progressive overload** though, I did introduce this slowly with regards to reps and heights of boxes for box jumps, although in future I could look to work at a higher percentage of my 1RM to further increase power. Although as mentioned above, I would have to consider the **frequency** and **recovery days** to reduce the negative effects of **DOMS**.

Throughout my PEP I trained 8 times a week (including specific swimming sessions) which is normal for a swimmer, however the ideal **rest and recovery** between plyometric sessions is 2-4 days depending on the intensity, meaning the nervous system has time to recover (13). Therefore, in future, it is recommended that rest and recovery days will have to be monitored more closely, as well as continuing to develop and/or maintain aerobic endurance to allow for greater rate of recovery between bouts of high intensity work in both training and my actual event. Maybe an earlier aerobic base training programme could have been conducted as this would potentially improve the capillary network in my body, allowing me to tolerate a greater load of training and could help me recover quicker (16).

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