

# LEVEL 3 SURF COACH RESEARCH ASSIGNMENT

**By Andrew Bolt  
Bribie Island SLSC, QLD**

## The Change in Heart Rate of Athletes During a 90m Beach Sprint.

### Introduction

This report investigated the change in heart rate of athletes during a 90m beach sprint. 8 beach sprint athletes (4 male, 4 female) were tested and had their heart rate assessed during the running of a 100% intensity beach sprint on soft sand. A heart rate monitor and GPS system were used to record regular heart rate measurements throughout the 90m beach sprint and 90 seconds after the run through. This report seeks to investigate the changes a 100% beach sprint race causes to heart rate, if heart rate is a limiting factor in sprint performance and what role cardio vascular fitness plays in sprinting.

To my knowledge, no significant research has been conducted on heart rate on sprinters. Many studies have been conducted on middle distance and endurance events, but I found none on sprinting, so as far as I know this is new research.

One of the human body's responses to physical activity is the heart rate increases, beating faster and stronger with each beat to pump more blood with each stroke (de Castella & Clews, 1996 p 2-4) among other events. If exercise is to continue or intensity is increased, all these events approach their maximum capacity in order to keep up with increased demand for energy (de Castella & Clews, 1996 p 2-5).

From the previous research into the changes of heart rate in response to exercise, it could be inferred that the heart rate will increase during the beach sprint, especially considering the high intensity it is performed at. But will the short time period the exercise is completed in and the consequent anaerobic energy systems used to produce the energy for this activity have an influence also. As no research had previously been conducted on this topic, I really did not know what results would be found.

### Methods

#### ***Subjects***

The subjects for this research were 8 beach sprint athletes (4 male and 4 female) who performed at an advanced level.

<b>Male-</b>	average age	21.5yrs $\pm$ 4.43
	average height	177.63cm $\pm$ 3.64
	average weight	72.51kg $\pm$ 8.77

<b>Female-</b>	average age	17.5yrs $\pm$ 1.91
	average height	160.73cm $\pm$ 2.41
	average weight	53.8kg $\pm$ 3.05

### ***Equipment***

- GPSports Systems SPI 10 Sports Performance Indicator (GPS/HR System)
- GPSports Athlete Management System
- Shoulder Harness
- 100m measuring tape
- 12 markers

### ***Procedure***

The testing took place on a 90m soft sand track that was relatively flat. The 90m course was measured out and two markers were placed 2m apart on the 20m, 40m, 60m, 80m and 90m mark to indicate the course for the subject to run between

All subjects performed a standard warm up for sprinting on grass including an 800-1000m jog, technique drills, static and dynamic stretching, and 5 x 50m run throughs increasing in intensity. Subjects then performed some practice block starts on the soft sand.

Each subject had the shoulder harness fitted to their body. The Sports Performance Indicator was placed in the harness in the middle of their upper back and the heart rate monitor was fitted to their chest. When a strong signal was being received, the subject was ready to be tested.

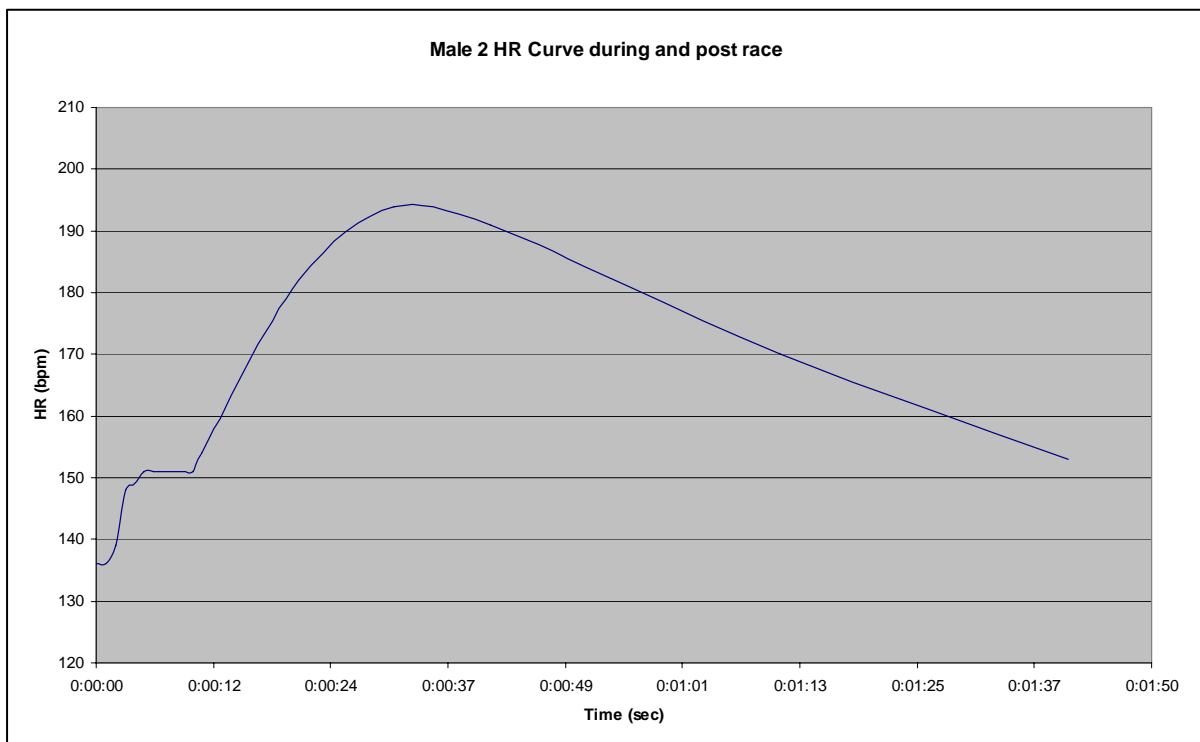
Subjects stood behind their blocks and received start commands "Take your marks, Set, GO!" On GO the subject exploded out of the blocks and sprinted at 100% intensity over the 90m course.

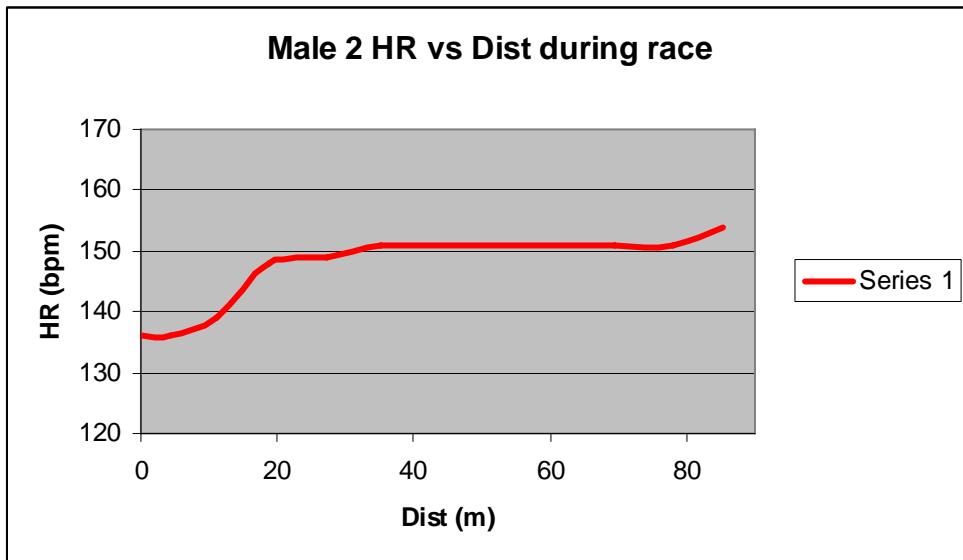
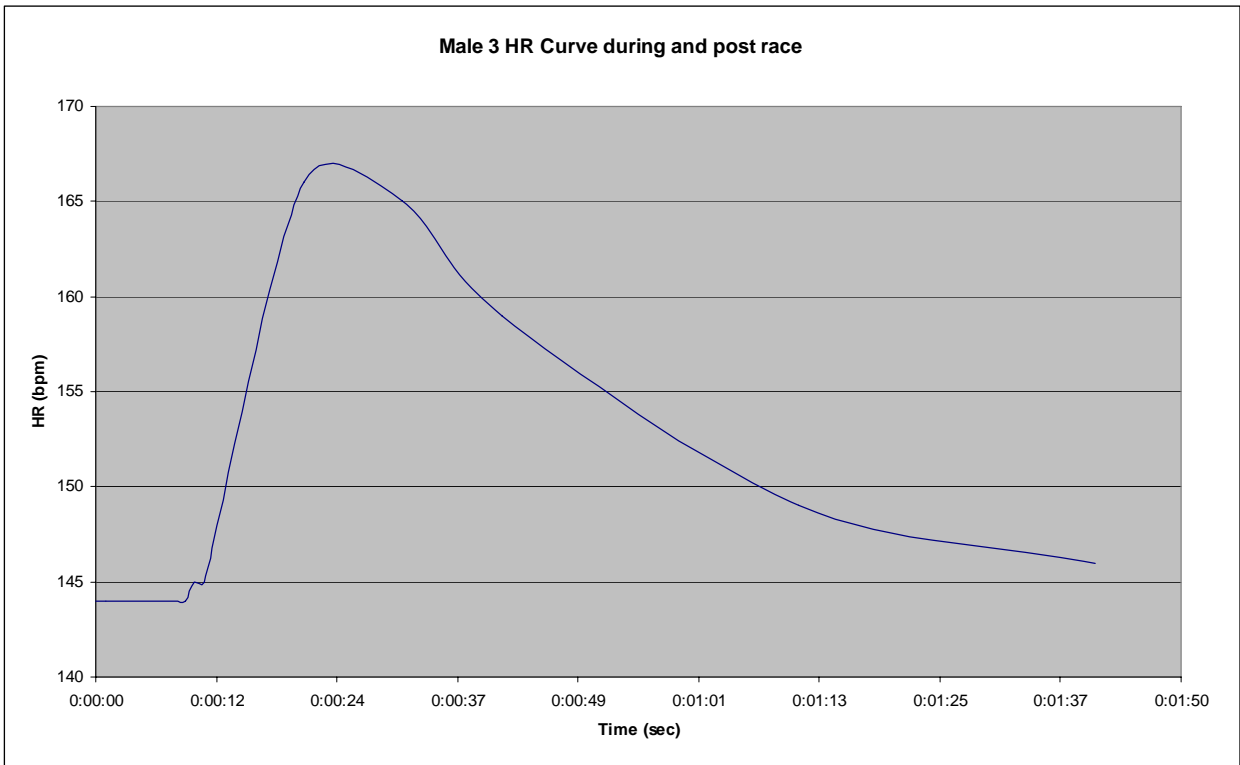
The Sports Performance Indicator recorded velocity and heart rate data for every second of the 90m sprint and 90 seconds recovery time after the activity.

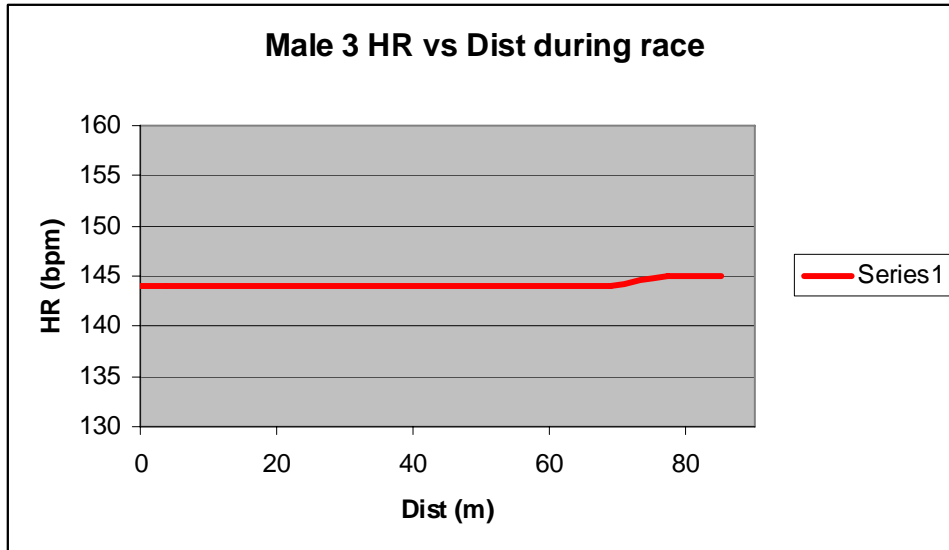
## Results

	Time (s)	Male 1		Male 2		Male 3		Male 4	
		Dist (m)	HR	Dist (m)	HR	Dist (m)	HR	Dist (m)	HR
<b>Start</b>	<b>0:00:00</b>	0	96	0	136	0	144	0	103
	<b>0:00:01</b>	1.3	96	4.4	136	3.7	144	1.3	103
	<b>0:00:02</b>	5.7	96	11.1	139	10.2	144	5.7	103
	<b>0:00:03</b>	12.4	96	18.9	148	18	144	12.4	103
	<b>0:00:04</b>	20.4	96	27.2	149	26.3	144	20.4	103
	<b>0:00:05</b>	28.5	96	35.3	151	35	144	28.5	103
	<b>0:00:06</b>	36.8	96	43.8	151	43.6	144	36.8	103
	<b>0:00:07</b>	45.3	96	52.5	151	51.9	144	45.3	103
	<b>0:00:08</b>	54.4	104	61.2	151	60.6	144	54.4	103
	<b>0:00:09</b>	62.8	111	69.5	151	68.9	144	62.8	103
	<b>0:00:10</b>	70.9	113	78	151	77.3	145	70.9	104
<b>Finish</b>	<b>0:00:11</b>	78.9	112	85.4	154	85.2	145	78.9	104
<b>Finish</b>	<b>0:00:12</b>	86.3	112		156		147	86.3	104
<b>10s rec</b>	<b>0:00:22</b>		163		182		166		160
<b>20s rec</b>	<b>0:00:32</b>		185		194		165		189
<b>30s rec</b>	<b>0:00:42</b>		165		191		159		170
<b>60s rec</b>	<b>0:01:12</b>		143		170		149		145
<b>90s rec</b>	<b>0:01:42</b>		142		153		146		142

Table 1 – Male Testing Results

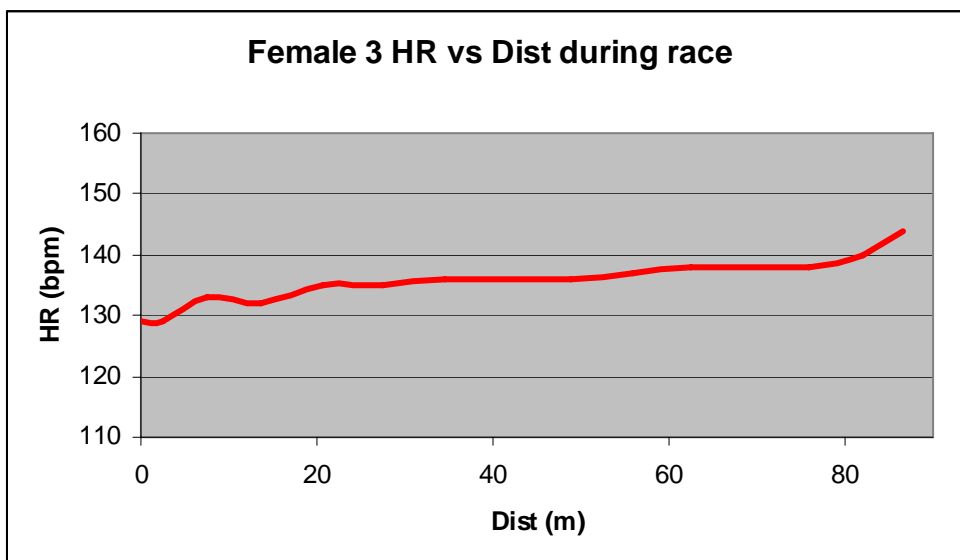
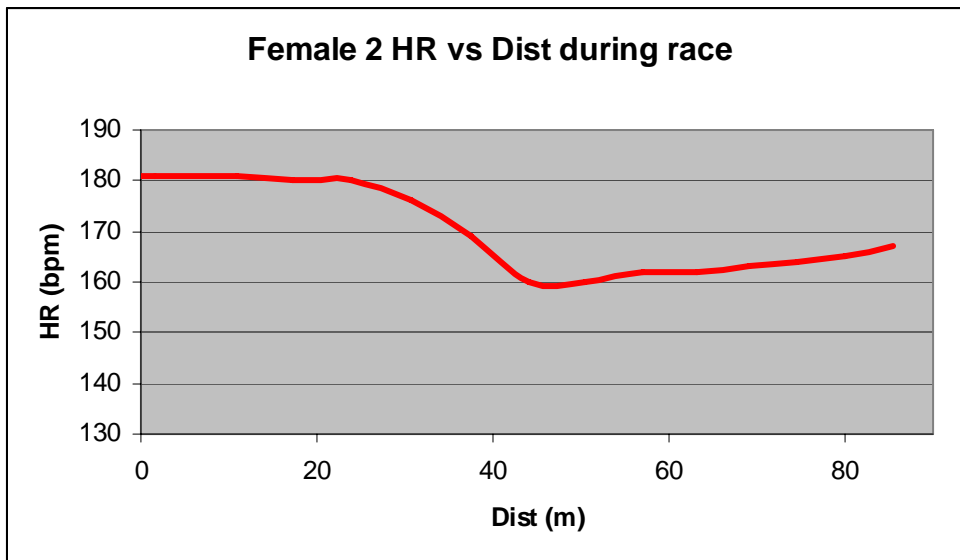
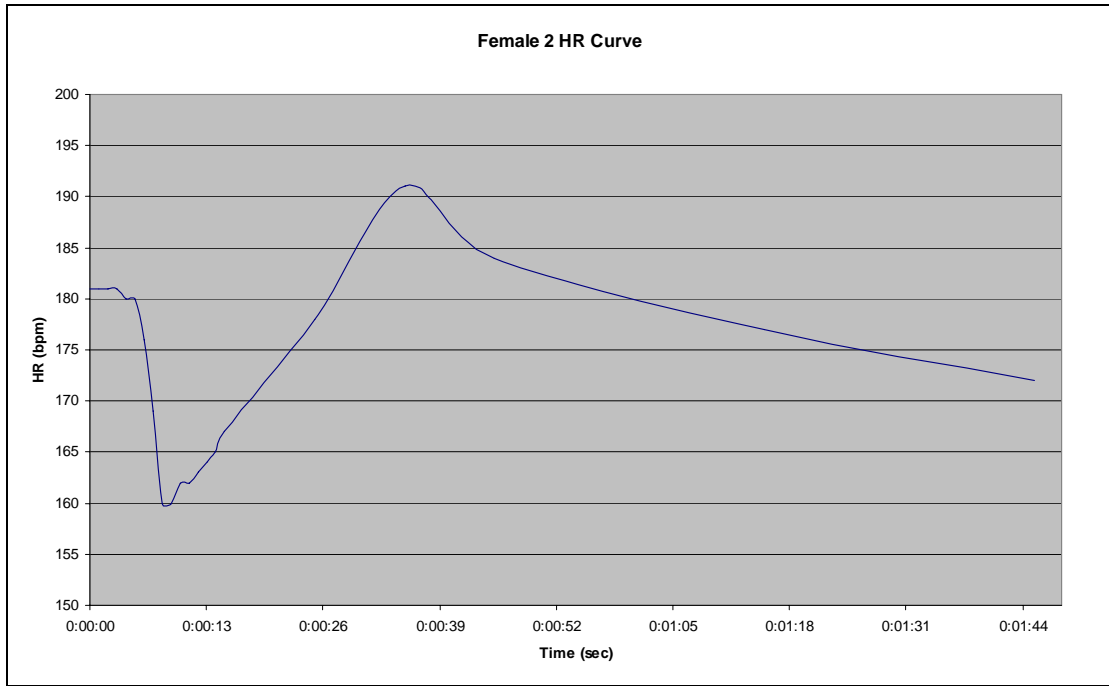






		Female 1		Female 2		Female 3		Female 4	
	Time (s)	Dist (m)	HR	Dist (m)	HR	Dist (m)	HR	Dist (m)	HR
<b>Start</b>	<b>0:00:00</b>	0	184	0	181	0	129	0	134
	<b>0:00:01</b>	0.4	184	1.5	181	2.6	129	0.4	134
	<b>0:00:02</b>	4.3	184	5.4	181	7.4	133	4.3	135
	<b>0:00:03</b>	9.8	187	11	181	13.7	132	9.8	135
	<b>0:00:04</b>	16.3	187	17.3	180	20.6	135	16.3	136
	<b>0:00:05</b>	23.1	187	23.9	180	27.6	135	23.1	136
	<b>0:00:06</b>	30.4	187	30.6	176	34.6	136	30.4	136
	<b>0:00:07</b>	37.4	187	37.5	169	41.7	136	37.4	136
	<b>0:00:08</b>	44.6	177	44	160	48.9	136	44.6	139
	<b>0:00:09</b>	51.8	171	50.5	160	55.8	137	51.8	139
	<b>0:00:10</b>	58.9	167	57	162	62.6	138	58.9	141
	<b>0:00:11</b>	66.1	153	63.1	162	69.5	138	66.1	141
	<b>0:00:12</b>	73.1	153	69	163	75.8	138	73.1	141
	<b>0:00:13</b>	79.8	153	74.6	164	82.1	140	79.8	145
<b>Finish</b>	<b>0:00:14</b>	85.7	153	80.1	165	86.7	144	85.7	147
<b>Finish</b>	<b>0:00:15</b>		157	85.5	167		149		150
<b>10s rec</b>	<b>0:00:25</b>		164		178		176		171
<b>20s rec</b>	<b>0:00:35</b>		195		191		188		193
<b>30s rec</b>	<b>0:00:45</b>		193		184		180		182
<b>60s rec</b>	<b>0:01:15</b>		180		177		174		176
<b>90s rec</b>	<b>0:01:45</b>		171		172		168		166

Table 2 – Female Testing Results



Subject	Male	Female
1	16	-31
2	18	-14
3	1	15
4	1	13
<b>Mean Ave</b>	<b>9</b>	<b>-4.25</b>
<b>STDEV</b>	<b>9.27</b>	<b>22.20</b>

Table 3 - Change in HR (bpm) during Beach Sprint

	Start	Finish	Max	% HRmax Start	% HR max Finish
<b>Male 1</b>	96	112	201	47.76	55.72
<b>Male 2</b>	136	154	203	67.00	75.86
<b>Male 3</b>	144	145	197	73.10	73.60
<b>Male 4</b>	103	104	193	53.37	53.89
<b>Average</b>	<b>119.75</b>	<b>128.75</b>	<b>198.50</b>	<b>60.31</b>	<b>64.77</b>
<b>STDEV</b>	<b>23.78</b>	<b>24.46</b>	<b>4.43</b>	<b>11.75</b>	<b>11.57</b>
<b>Female 1</b>	184	153	200	92.00	76.50
<b>Female 2</b>	181	167	204	88.73	81.86
<b>Female 3</b>	129	144	202	63.86	71.29
<b>Female 4</b>	134	147	204	65.69	72.06
<b>Average</b>	<b>157.00</b>	<b>152.75</b>	<b>202.50</b>	<b>77.57</b>	<b>75.43</b>
<b>STDEV</b>	<b>29.54</b>	<b>10.21</b>	<b>1.91</b>	<b>14.85</b>	<b>4.87</b>

Table 4 - % of HR max at start and finish of beach sprint

### **The heart rates at the start of the run through (Table 1 & 2).**

Heart rates ranged between 96 bpm and 144bpm (or 47.76 to 73.1% HRmax) in the male subjects and 129 and 184 bpm (or 63.86 – 92%) in the female subjects. The differences in HR at the start of the beach sprint can be attributed to the following factors –

- the amount of time between the warm up and the run through
- the volume and intensity of warm up
- the anxiety of the subject before the beach sprint
- the amount of mental psyche up of the subject before the beach sprint

### **Heart rate during the 90m run through (Table 1, 2 and 3).**

In the male subjects the heart rate increased between 1 and 18 beats per minute (bpm) with the average increase in heart rate being  $9 \pm 9.27$  bpm. These results calculate an average of a 4.46% increase in %HRmax (Table 4). In the female subjects the heart rate actually decreased during the beach sprint for two subjects and increased in line with the male averages for the remaining two female subjects. Changes in heart rate ranged from -31 and +15 beats per minute with the average change being  $-4.25 \pm 22.20$  bpm. These results calculate to an average of a 2.14% decrease in %HRmax (Table 4)

The female subjects provided less consistent results and the mean average results don't really give a clear representation of the group. Two female subjects had HR increases consistent with the results found in the male subjects with similar increase in heart rate. However, the other two female subjects actually experienced a decrease in their heart rate. Looking at the

male subjects results and the two female results, which indicated an increase in heart rate, it can be inferred that the increase in heart rate is not that significant. An average increase of 9 bpm or 4.46% HRmax is not a great increase.

The heart rates of the two subjects whose heart rate decreased were very high at the start and the decrease in heart rate could be attributed to the following factors

- once the beach sprint actually started the athletes mind is diverted from the anxiety and mental psyche of the pre race routine and is focused on the task at hand
- although sprinting is performed at very high intensities, experienced sprinters perform this activity in a organized and relaxed state

**The % of maximum heart rate (HRmax) at the finish of the beach sprint (Table4).** The heart rate at the finish of the beach sprint for male subjects ranged between 53.89 and 75.86% HRmax with the average of  $64.77 \pm 11.57\%$ , whilst female subjects were a little higher ranging between 71.29 and 81.86% with the average of  $75.43 \pm 4.87\%$ . It was interesting to see the heart rates of the two female subjects whose HR decreased did decrease to a similar heart rate and %HR max as the other female subjects. The %HRmax for all subjects at the finish of the race were in the ranges of light to moderate physical activity levels (de Castella & Clews, 1996 p 2-17).

#### **The time period when peak HR was achieved (Table 1 & 2)**

This finding was consistent with all subjects. For 7 of the 8 subjects, peak HR was achieved 20 seconds post race. The other subject achieved peak HR at 10 seconds post race. Peak HR ranged from 166 – 194 with an average of  $183.5 \pm 12.2$  bpm (or  $92.5 \pm 6.8\%$  HRmax) for male and 183 – 195 with an average of  $189.25 \pm 5$  for females (or  $93.5 \pm 3.2\%$  HRmax). The Peak HR reached by the subjects range in the high to very high intensities (de Castella & Clews, 1996 p 2-17).

- the demand of blood supply to working muscles for anaerobic energy production was not as high as the demand of blood supply to remove accumulated metabolic wastes and replenish fuel after the effort.

#### **Discussion**

If we go back to the start, the objective of this report was to investigate the change in heart rate of athletes during a 90m beach sprint. The results of this report suggest that the answer is not much. An average change of 4.46% in males and -2.14% in females. The heart rate is only increased to a level of 64.77% HRmax in males and 75.43% HRmax in females.

However, the effect of a 90m beach sprint does significantly increase the heart rate, but most of this increase is post race. A Peak HR of 92.5% HRmax in males and 93.5% in females is achieved 20 seconds post race and remains at a high level for more than 90 seconds post race.

The findings of this study suggest that heart rate is not a significant limiting factor in sprint performance. Therefore an athlete's level of aerobic fitness and

conditioning should not have a great effect on the performance of a 90m beach sprint. Other factors eg. Strength, power, speed, technique and mental factors have far more effect. The demand for the heart to pump blood full of oxygen and fuel and remove metabolic waste is not great during the performance of the beach sprint.

However, heart rate and aerobic fitness and conditioning would be a significant factor in the recovery from the 90m beach sprint in order to perform a second repetition of the 90m beach sprint, especially if the recovery time was short.

### **Conclusion**

This report investigated the change in heart rate of athletes during a 90m beach sprint. 4 male and 4 female subjects were tested and it was found that the heart rate only changed marginally during the performance of the beach sprint, however it did increase significantly post race, peaking 20 seconds post race and remaining high for more than 90 seconds post race. It is concluded, that heart rate and aerobic fitness does not have a significant influence on sprint performance, and therefore it should not be a major component of sprinting programs. It is also concluded that some aerobic conditioning is needed to ensure adequate recovery from a beach sprint performance in order to perform another repetition, especially if the recovery period is short and the beach sprint performance needs to be high.

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