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ORIGINAL ARTICLE

The Relationship Between Repeated Sprint Performances and 50m and 100m Swimming Degrees of Swimmers

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ABSTRACT

Aim: The aim of this study is to investigate the relationship between short distance swimming performance and repeated sprint ability in swimmers.

Methods: 12 male swimmers between the ages of 14-18 from Denizli Pamukkale University Swimming Sports Club Performance team voluntarily participated at this study. Freestyle swimming time of the subjects was measured by using Casio stopwatch. 10x15-m, 50-m and 100-m freestyle swimming degrees of swimmers were recorded. The ideal sprint time (IS), the total sprint time (TS) and the performance decrement (PD) were determined after repeated sprint test (RST). Lactate levels were recorded at the end of each test. The Borg scale was used to determine the perceived difficulty level. For the statistical analysis Pearson's correlation was used to determine the correlations between 50- m and100-m freestyle swimming time and swimming times obtained at the end of RST (IS, TS, PD).

Results: Significant relationships were found between the 50-m and 100-m swimming performance ($p<0.01$). Significant correlations were found between the IS and the TS and the 50-m swim results ($p<0.01$) and also the 100-m swim results ($p<0.05$). Significant correlations were found between the 50-m lactate values and 100-m lactate values ($p<0.05$). Significant relationships were found between 10x15-m RST lactate values and 50-m lactate values ($p<0.05$). Moreover, strong relations were found between the 10x15-m RST lactate values and 100-m lactate values ($p<0.01$).

Conclusion: This study has shown that repeated sprint ability as well as higher anaerobic capability as reflected by the short distance.

Keywords: swimming, repeated sprint ability, short distance swimming performance

INTRODUCTION

Swimming; It is a sport branch that includes many factors such as high level aerobic and anaerobic endurance, strength, flexibility, speed, quickness, rhythm, coordination, sportive performance and technical skills[1]. Although individual sports (such as athletics, swimming) are branches that involve alternating movements, they include short-term high-intensity repetitive activities. There are 4 branches in swimming as free (krawl), butterfly, back and breaststroke swimming. Freestyle swimming is the fastest swimming among the competition style. Today, swimming is represented in 16 different Olympic branches ranging from 50 m to 1500 m. Those between 50-100 m are considered as short distance (sprint), those between 200 m are considered as medium distance and those between 400-1500 m are considered as long distance branches, and anaerobic processes are thought to be more dominant in swimming branches below 200 m. Although anaerobic performance is important for all kinds of sportive activities, its importance increases even more in some sports branches where anaerobic performance is predominantly used. It shows the anaerobic performance of 25m–50m–100m at swimming distances. Sprint performance is fundamental to success in several sports[2]. To improve various dimensions of sprint performance, many athletes undertake resistance training. Such training has received support from research reporting that speed – strength training can markedly improve single-sprint performance[3]. In addition, Dowson, Nevill, Lakomy, Nevill and Hazeldine, 1998[4] have reported a relationship between strength of the leg muscle groups and sprint times, suggesting that strength is an important contributor to single-sprint performance. Repeated sprint tests are commonly used in branches where anaerobic performance is dominant[5]. Repeated sprinting ability; It is an ability that is supported by short rest periods and ensures the reproduction of maximum sprint effort and is considered an important conditioning component for many team sports[6]. While high-level repeated sprint tests are needed in team sports, repeated sprint tests are important for athletes who do individual sports. The aim of this study; to examine the relationship between short distance (50 m and 100 m) swimming degrees of swimmers and their repeated sprint performance. It has been suggested that a high level of aerobic fitness is a prerequisite for enhanced performance during repeated-sprint activities[7]. However, the correlation between aerobic fitness (e.g., VO2 max) and indices of RSA has been inconsistent. While some authors have reported significant correlations between the two (e.g.[11,8]), others have failed to do so (e.g.[9,10]). Further research is therefore required, especially with swimming as the exercise mode, as most repeated-sprint studies have employed running[11,12] or cycling[13,8]. To the best of our knowledge, only one study[12] has investigated indices of RSA in swimming.

MATERIAL AND METHODS

Subjects: Denizli Pamukkale University Swimming Sports Club A team Performance athletes, 12 male swimmers aged between 14-18 (Xage: 15.5±1.93 years, Xheight: 173.91±11.40 cm, Xweight: 76.58±5.46 kg) participated voluntarily. The subjects were informed about the possible risks and advantages of the study and gave their informed permission to participate in this study, which was approved by the Clinical Research Ethical Committee of Pamukkale University (60116787-020/125120).

Study Design: Three separate swimming tests were performed on the athletes. 50 m swimming on the first day, 100 m swimming on the second day and 10x15 m repetitive sprint protocol on the third day were applied. Each test was performed in an indoor pool (50m and 100m; 50m Olympic swimming pool, 10x15m repetitive sprint protocol in 25mx15m pool). In all measurements, the temperature of the water was 26°C and the temperature of the pool was 26-28°C. A 48-hour rest was given between each test. Freestyle before each test; 800m swimming and 4x15m swimming warm-up protocols were made.

Height and Body Weight Measurement: Subjects' height was measured with a stadiometer with an accuracy of ± 0.01 meters and their body weight with a stadiometer with a precision of ± 0.1 kilograms (Seca, Germany).

Swimming Degree Measurement: The swimmers' 10x15m freestyle, 50m freestyle and 100m freestyle swimming degrees were recorded with a casio brand stopwatch with a precision of 0.01 seconds. Swimming degrees were recorded by keeping 3 stopwatches in accordance with FINA rules (the middle of the 3 stopwatches or, if any, 2 same degrees were recorded).

Lactate Measurement: The lactate values were measured with Lactate Plus 3 minutes after the subjects' 10x15m, 50m and 100m free swimming performances.

Borg Scale Measurement: In order to measure the degree of difficulty of loading; Borg scale (1-10) was used after the subjects' free swimming performances of 10x15m, 50m and 100m.

10x15 m Repeated Sprint Protocol: All athletes swam 15 m in the form of sprints with 10 repetitions (10x15 m) with 30 seconds of rest between repetitions. In this test; In each sprint, the athletes swam 15 m by pushing themselves from the wall with two feet (to prevent the swimmers from going underwater) in the water and their degrees were recorded. During the rest periods between sprints, the athlete came to the exit wall with a backstroke style through the water.

The following parameters were calculated in the 10x15 m repeated sprint test;

- Ideal swimming time (IS): It is the best of the 15m swimming distances.
- Total swimming time (TS): It is the sum of the 15m swimming distances.
- Performance Decrement Times (PD):

The percentage of performance decline was calculated with the following formula[8].

Performance Decrease Percentage (PDP) = (Total Sprint Time x 100 / Ideal Sprint Time) - 100

Total sprint times (TST) = S1+S2+S3+S4+S5+S6+S7+S8+S9+S10

Ideal Sprint Time (IST) = Best 15m sprint swimming distance x 10

The best 15 m sprint swimming distance x 10 with this formula, the sum of the duration of each distance is taken as the total time. The ideal total time was taken as the time obtained by multiplying the best grade at each distance by 10.

Statistical Analyses: In the statistical analysis of the data, descriptive statistics regarding the data obtained from the anthropometric characteristics, swimming performance grades, lactate values and borg scale of the swimmers were calculated. The relationship between 50m and 100m free swimming times and the values obtained at the end of the repeated sprint test (ideal time, total time and performance decrease) was examined with Pearson Correlation analysis and SPSS 22.0 package program was used and p<0.05 value was taken as the significance level.

RESULTS

Table 1. Descriptive statistics for swimmers' swimming distance, lactate, borg scale and repeated sprint performance variables

	Mean ± sd
50m (s)	28.82±2.02
100m (s)	58.71±1.67
10x15m (s)	9.94±0.05
50m La (mmol)	7.3±3.14
100m La (mmol)	7.26±2.89
10x15m La (mmol)	4.05±2.48
Borg Scale (1-10)	5±1.20
Ideal Sprint Time (IST)	62.11±5.28
Total Sprint Time (TST)	64.36±5.76
Performance Decrease Percentage (%)	3.61±1.99

Table 2. Relationship between 50 m and 100 m free swimming times of swimmers

Distance	50m(s)	100m (s)
50m(s)	1	0.855**
100m (s)	0,855**	1

*p<0,05; **p<0,01

A statistically significant correlation was found between the 50 m swimming performance and the 100 m swimming performance of the swimmers (p<0,01).

Table 3. Relationship between 50m and 100m free swimming times of swimmers and repeated sprint performance variables

Distance	Total Sprint Time (s)	Ideal Sprint Time (s)	Performance Decrease Percentage (%)
50m(s)	0,713**	0,713**	0,118
100m (s)	0,669*	0,605*	0,409

*p<0,05; **p<0,01

A statistically significant correlation was found between ideal sprint time and total sprint time duration and swimming performances of 50 m (p<0.01) and 100 m (p<0.05).

Table 4. Relationship between 50m and 100m and 10x15m La values of swimmers

La (mmol)	50m (s)	100m (s)	10x15m (mmol)
50m (mmol)	1	0,652*	0,610*
100m (mmol)	0,652*	1	0,829**
10x15m (mmol)	0,610*	0,829**	1

*p<0,05; **p<0,01

A statistically significant correlation was found between the lactate values of swimmers after 50 m swimming and 100 m swimming lactate values (p<0.05). A statistically significant correlation was found between the lactate values obtained from the 10x15 m repeated sprint test and the 50 m lactate value (p<0.05) and between the 100 m lactate value (p<0.01).

DISCUSSION

During intermittent exercises, performance depends on the ability to recover from previous work bouts. The similarity in both mean and peak power output in the constant and decreasing recovery patterns suggests that the participants recovered in a similar manner from recovery durations of 30 s[14]. This demonstrates that the pattern of hange in cycle power output, and thus repeated-sprint ability, was altered in different ways depending on whether a fatiguing protocol was performed with a constant, an increasing, or decreasing recovery modality. The work of Balsom and colleagues (1992) highlighted the metabolic consequences of preceding exercises bouts when high-intensity running sprints were interrupted by short intervals of recovery. In the present study, the increasing recovery pattern required the participants to repeat all-out sprints with very short recoveries from the outset. The highenergy demand placed on these first few sprints may have led to earlier biochemical perturbations. It is well recognized that an important function of the recovery process between repeated sprints is to replenish phosphocreatine stores and restore muscle pH towards resting values[15]. From a metabolic standpoint, it is possible that with the very short recovery interval in the increasing recovery pattern, the observed decline in peak power output may have been partly due to insufficient phosphocreatine restoration, inhibition of contractile activity through a decrease in muscle pH, and/or changes in ionic concentrations[16,17]. This was probably not the case during the constant and decreasing recovery patterns, where metabolic disturbances may have been delayed owing to the long recovery periods that allowed the participants to reproduce performance. These data, combined with those of Balsom et al., 1992[16] and Billaut et al., 2003[18] suggest that repeated sprint ability may only be paired when a critically short recovery period is used. Thus, changes in exercise – recovery phases within multiple-sprint protocols appear to influence repeated, short sprint performance, and the present study distinguished the recovery pattern between sprints as an important component of repeated-sprint ability. The statistically significant relationship between releated sprint ability and short distance swimming values of 25 m, 50 m and 100 m is explained by the fact that the phosphogen system and anaerobic glycolytic energy system are active as the dominant energy source. In this study, since 8x15 meters do not last up to 10 seconds in the repetitive sprint test protocol, a completely phosphogen system was used and regeneration was achieved with the given rest periods. Meckel et al., 2013[5] looked at the relationship between aerobic and anaerobic performance of repeated sprint test in water polo players and swimmers. They found a significant relationship between the 25m swimming performance of water polo players and swimmers, and the total swimming time and ideal swimming times in the relationship between the 8x15 m repeated sprint test and the 25 m and 800 m swimming. They could not find a significant relationship between repeated sprint test and 800m swimming performance. They could not find a relationship between 25m swimming performance and 800m swimming performance. They found that between swimmers and water polo players, 25m swim degrees were faster than 800m swim degrees. Meckel et al., 2012[12] looked at the relationship between the repeated sprint abilities of short and long distance swimmers in their study. They found a strong correlation between their 100m swimming performance and their 2000m swimming performance. They could not find a relationship between the 8x15m repetitive sprint test and 100m and 2000m swimming performances. Between ideal time, total time and performance degradation times; They could not find a significant relationship between 100m and 2000m swimming performances. Mujika et al., 2009[19] examined repetitive sprinting ability and blood lactate responses in 134 young football players in their study and found a high-level positive statistically significant relationship between the best sprint time and blood lactate concentration (r=0.78, p=0.001). These results show that the repeated sprint test can be used to indirectly see lactate responses, which allows us to have information about anaerobic performance. Repeated sprint tests have become a common subject of study to measure the performance of athletes engaged in team sports. Fatigue and power output during repetitive sprints are determined by the number of repetitive sprints, their intensity, duration, and work periods. The time ratio between exercise and recovery appears to be a key factor, since recovery time is thought to determine the intensity of total exercise[14]. The statistically significant relationship between sprinting ability and short distance swimming values of 50m and 100m can be explained by the fact that the phosphogen system and anaerobic glycolysis energy system are active as the dominant energy source. In this study, we can say that repetitive sprint ability reflects anaerobic performance in short distance swimming.

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