Changes in Swimming Performance after Different Active Recovery Protocols in Young Breaststrokers

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Abstract

Introduction: The purposes of the study were to compare the impacts of two recovery protocols on blood lactate clearance and swimming performance following maximal 200m breaststroke (BR).

Method: Eleven young males BR volunteered to participate in the study. Two programs of active recovery conditions, a self-prescribed recovery and land based active recovery with a total duration of 25-min, were adopted for maximum 200m swim. Levels of peak blood lactate [La-] concentration, taken from ear lobes, were determined at 5 min after completion of 200 meters of maximum swimming. Serial concentrations of blood lactates were collected at 10, 20 and 25 min during the random interventions of 2 active recovery protocols. After one-hour of recovery, their performance was retested to assess for a 100m BR. Paired sample t-test, Analysis of variance, Repeated measure design and Turkey's test were used. There were no significant differences ($P > 0.05$) between self-prescribed and land based active recovery groups for BR 200m swimming time.

Result: There were no significant differences the performing swimmers in [La-] within 5 min of pre-intervention. Blood lactate level after 10 min between two recovery protocols were detected after 20 and 25min. Blood lactate level during the last two periods after using self-prescribed protocol was decreasing faster than that use in land based active recovery. There were also no significant differences for swimming performance effectiveness.

Conclusions: It is concluded that an incomplete recovery may have a negative impact on the swimmers performance resulting in the decrease of young swimmers' performance effectiveness. Therefore land based recovery would help maintains a good level amongst the performing swimmers.

Keywords: Blood lactate, Active recovery, Swimming performance

Introduction

International Swimming competitions are FINA World Championships, FINA World Swimming Championships (25 m) and Asian Swimming Championship, especially for the young athlete are FINA World Junior Swimming Championships. The Olympic Committee has the game for Asian Age Group Swimming Championships and Sea Age Group Swimming Championships, Youth Olympic Games and Asian Youth Games. Currently, there have been competitions of swimming throughout Thailand such as Thailand Nation Game, Thailand Nation Youth Game, The University Sport of Thailand, Speedo Thailand Age Group Swimming Championships.

For young swimmers, the components of the readiness in terms of physiological and energy system are crucial during both the training plan and competition. The ability of swimmer influence of energy system and biomechanics, especially among young swimmers.[1] The young athletes who were trained for aerobic energy system, it was the first one to develop and the next were technical and individual skills.[2] Besides, several anaerobic systems were also very important for sprinter swimmer 100m and middle-distance swimmers, especially at 200m. Then breaststroke 200m have high energy expenditure and anaerobic system, is highest blood lactate.[3][4]

The problem was that in swimming competitions, there are many events in one day. During a competition in each “heat”, there resting time between 30 minutes and 1/2 hours for semi-final and final session. This competition caused the higher blood lactate and muscle fatigue. Lactic acid is a factor leading to muscle soreness and muscle fatigue, For energy system, distance swimmers had anaerobic-lactic system between 60 -120sec for the highest rate of lactic acid due to the speed and intensity increase resulting in muscle fatigue and quickly decreased of the performance.[5]

In fact, recovery will help athletes maintain good performance during their training, exercise or competition. It was very beneficial for body restoration. Athletes can remove them with recovery for energy from nutrients and physical aspects such as active recovery, cool down, massage, heat and cold. For the active recovery, there were dynamic stretching; swimming, running, walking, massage, or moderate exercise; for the passive recovery, it can be done in several ways such as, static stretching, hydration, nutrition, sleep, water immersion therapy[6][7] USA swimming suggested that the recovery could be divided into 3 components: duration of recovery, intensity of recovery and the rest duration before a competition in next event.

It is important for coach and athletes to ensure that the athletes are ready for competition in the next event without fatigue. Athletes must reclaim for a type of recovery from muscle fatigue to normal state faster and can come back to competition and training effectively. From the reviews of related studies, self-prescribed recovery program and land based active recovery program can decrease blood lactate. The land based active recovery can be of assistance in the case that the recovery pool is not available; especially in Thailand here there are only a few recovery pools. On the other hand, they may be alternative to the recovery.

In a swimming competition, there is a limited time to rest for the athletes who are in training session and competition. As a consequence, the aim of this study was to compare the impact of two recovery protocols on blood lactate clearance and swimming performance

Methods/Methodology

Eleven young males BR swimmer were engaged. Regarding the participants, they were obtained by calculating from β Power of test 0.8[8]

$$n = \frac{(t_{\alpha,n-1} + t_{\beta,n-1})\hat{\sigma}_d}{\mu_d}$$

They were trained in Assumption Sriracha School club aged: 14 ±1.4 years, weight 58.79 ± 11.34 kgs, and height 166.45±7.58 cms. They were healthy and had no injury with medical examination informed in written consent. Ethic approved by committee of faculty of sport science, Burapha University.

Two programs of active recovery conditions, a self-prescribed recovery and land-based active recovery with a total duration of 25-min, were adopted for maximum 200m swim. Their personal best time (PB) of 100m and 200m BR, recorded in the official competitions one week before testing were collected as the baseline data for the study. Levels of peak blood lactate [La-] concentration, from ear lobes, were determined at
5 min after completion of 200 meters of maximum swimming. Serial concentrations of blood lactates were collected at 10, 20 and 25 min during the random interventions of 2 active recovery protocols. After that, there was a 1-hours rest and followed by swimming BR 100m. The results were then analyzed by using the following statistics: Paired sample t-test, Analysis of variance, Repeated measure design and Turkey's test.

Results and Discussion

The impact of two recovery protocols on blood lactate clearance and swimming performance were showed in table1, figure1. and 2.

Table1. Blood lactate before and after swimming BR 200m

Testing for blood lactate	Self-prescribed recovery		Land based active recovery		t	P
	Mean	S.D.	Mean	S.D.		
1. Pre-test blood lactate	1.67	.32	1.35	.36	2.82	.02*
2. Peak lactate	6.95	1.93	6.99	1.74	-.14	.88

p=.05

(Table 1) Blood lactate before swimming breaststroke 200m of the two groups were significantly (p=.05) (1.67± .32 mmolL^{-1} and 1.35± .36 mmolL^{-1}). For blood lactate after swimming breaststroke 200m, there were no significant differences in self –prescribed recovery group and land based active recovery group (6.95 ± 1.93 mmolL^{-1} and 6.99 ± 1.74 mmolL^{-1})

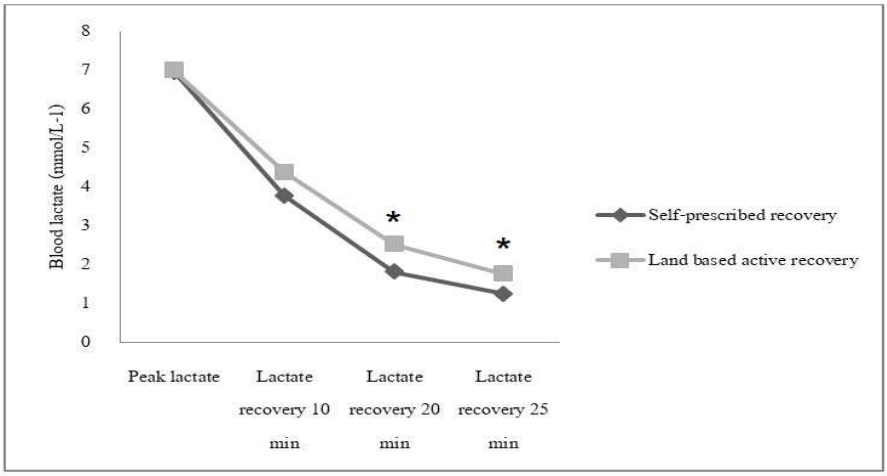

Figure1. Blood lactate after active recovery program two types (p=.05)

From figure1, There were no significant differences between blood lactate after the application of self-prescribed recovery and land based active recovery ((3.77 ± 1.34 mmolL^{-1} and 4.37 ± 1.24 mmolL^{-1}) for 10 minutes. However, there were significant differences between blood lactate after self-prescribed recovery 20 minutes and land based active recovery (1.81 ± 0.77 mmolL^{-1} and 2.52 ± 0.52 mmolL^{-1}). Likewise, blood lactate after self-prescribed recovery 25 minutes was 1.24 ± 0.41 mmolL^{-1} and land based active recovery was 1.76 ± 0.39 mmolL^{-1} (p=.05).

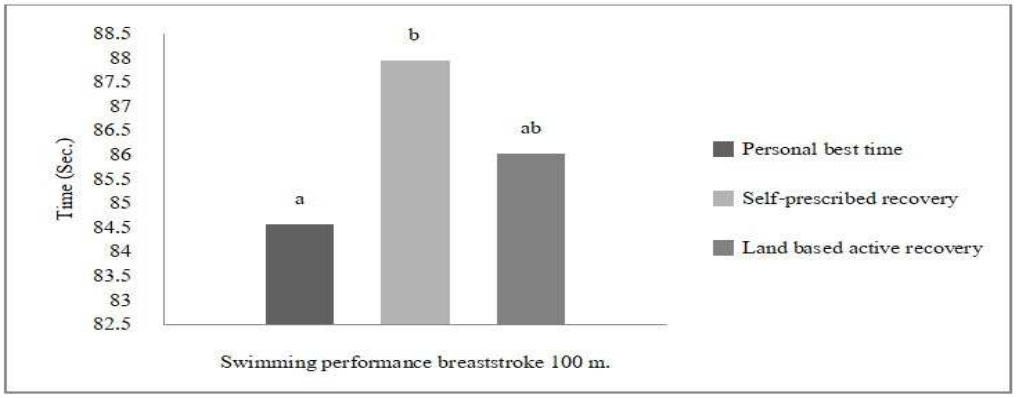

Figure2. Compare PB BR 100m with swimming performance after 2 type's active recovery programs

From figure2, the comparisons of swimming performance between personal best time (PB) BR100m, self-prescribed recovery and land based active recovery suggested that personal best time breaststroke100 m is the best (84.56 ± 8.72sec), and there were no significant difference between self-prescribed recovery and land based active recovery (87.94 ± 10.52 and 86.02 ± 10.86sec) ($F = 6.77$), ($p = .006$). When compared personal best time 100m, the percentage of swimming time for the self-prescribed recovery and land based active recovery were 96.15% and 98.30%, respectively.

Conclusions

Blood lactate; Regarding blood lactate after swimming BR 200m, there were no significant differences in self-prescribed recovery group (6.95 ± 1.93 $mmolL^{-1}$) and land based active recovery group (6.99 ± 1.74 $mmolL^{-1}$) (p=.05) (Table 1) Energy system used in BR swimmer 200m time during 60-120sec is in anaerobic energy system; therefore, the product of this energy is lactic acid. Process of incineration of glucose is incomplete. There is not enough oxygen.[9] For blood lactate concentration and clearance in Elite Swimmers during competition, there was a report that sprint swimmers 100m and middle-distance swimmers had high blood lactate. Likewise, blood lactate after self-prescribed recovery 25 minutes was 1.24 ± 0.41 $mmolL^{-1}$ and land based active recovery was 1.76 ± 0.39 $mmolL^{-1}$ (p=.05). After the application of self-prescribed recovery and land based active recovery for 10-minute, blood lactate was reducing to 45.76% and 37.48%, respectively. After a 20-minute recovery, blood lactate could reduce to 73.96% and 63.95%, respectively; and 82.16% and 71.82% for 25 minute, respectively. (Figure 1)

Blood lactate during recovery; for active recovery program with athletes was recommended. In a middle-distance swimming 200-400m, 25min was used for the recovery with heart rate intensity during 130-140 BPM.[10] For American training session, the Intensity for En1 should decrease to recovery. Land based active recovery with light intensity walk, stretching and rest can decrease blood lactate.[11] studied the effect of three recovery protocols on blood lactate clearance after race pace swimming using self-prescribed, coach-prescribed, land-based active recovery in 18 males and 12 females suggested that self-prescribed, coach-prescribed and land-based decreased blood lactate but the first one could decrease blood lactate faster than the last one. Active recovery after the exercise of the large muscle groups continued and could lead to muscle cramp avoidance, muscles strength, storage of good energy and decrease of blood lactate. Active recovery is a good way to reduce lactic acid because could in increase blood flow and caused lactic acid oxidation used by liver, heart, respiratory muscle since this tissue performs oxidation lactic acid through Cori cycle.[12] Active recovery is mostly found in the pattern of recovery which is composed of the total of resting time, the duration of active recovery and intensity of recovery. All of these are the most impotent components for active recovery program.[13]

Swimming performance efficiency; when compared personal best time 100m, the percentage of swimming time for the self-prescribed recovery and land based active recovery were 96.15% and 98.30%, respective. High intensity exercise within 3-minute uses energy from ATP (Adenosine triphosphate; ATP). After the exercise, whether high blood lactate production is high or low depends on the amount of oxygen and intensity of exercise. This results in the decrease of muscular contraction, muscle pain, fatigue, as well as the decrease of performance efficiency. For athletes, recovering from an interval training session or competing in heats on successive days, the best procedure may be to combine an initial active recovery (just to the point of regaining a near-resting heart rate) with stretching and then engage in a passive recovery during which carbohydrates are consumed. During active recovery, myoglobin can be replenished with oxygen. This quick ATP energy storage of the amount of ATP depends on the activity recovery each person uses to recovery,[14] while active recovery may increase the efflux and flow of lactate to other tissues for oxidation[15] and resynthesizing in glycogen.[16] The value of swimming performance efficiency after self-prescribed recovery and land based active recovery was close to PB to 96.15% and 98.30% showing that after active recovery of

2 types, athletes have good performance.[17] studied swimming tests among elite swimmers in high volumes of training. It showed that their swimming performance efficiency was closed to PB to 93-96%. During the data collection, the participants were in their practices to prepare for the competitions. This would make them not ready for the peak performance. They did not have a taper. If they did, their efficiency would increase up to 2-3%.

The results from this research showed that self-prescribed recovery and land based active recovery could decrease the blood lactate and help keep good swimming performance. Land based active recovery program could be and alternative for athletes and coaches. It could be used for competition swimming without a recovery pool.

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