Effects of 3 days Training with Hyperoxia on Muscle Energy Metabolism and Systemic Circulation

Wang, Y. C, Smith, R. S., Jang, J. T.
National Taiwan Sport University, Taoyuan Taiwan

Sport Performance Diagnostic Institute

Introduction

Mankind's dream of running faster on the track have led sports scientists and coaches to work together to refine the athletes peaking cycle. In this study we looked at the 400 m run which is a combination of speed and endurance. One month before a race, athletes need to be in their best physical condition, at this point fine tuning the athlete is necessary to ensure the athletes performance peaks on the day of competition. Therefore, the aim of this study was to design a training protocol for the 400 m run. The training protocol consisted of 3 days training with hyperoxia on the treadmill. The goal was to enhance the athlete's performance by altering the metabolism and systemic circulation.

Methods

Training consisted of 3 days training on the treadmill under hyperoxic conditions. Six 400 m male track specialists, mean age 17 ± 1.17 years of age were requited. The research test consisted of a 400 m performance (pre - post test). Training tests were separated into day 1 (Tr-1) and day 3 (Tr-3) and represented the intermittent mode, and day 2 (Tr-2) represented continuous running. Intermittent workload Tr-1 and Tr-3 was set at 90 % of the subject's best time for (3x3x90 %); continuous running was sustained at 50 % performed on Tr-2.

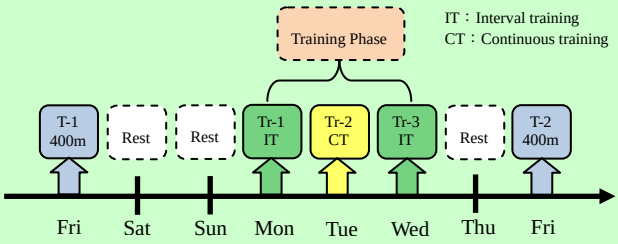

Figure. 1. Experimental flow chart

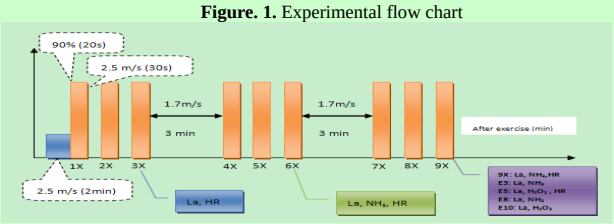

Figure. 2. Training test Tr-1 and Tr-3's training methods, content and biological parameters

Statistics

All data are presented as mean±SE. A paired *t*-test was used to determine the 400m performance and lactic acid. The differences of lactic acid, ammonia, free radicals, and heart rate between the two training sets (Tr-1 and Tr-2) were analyzed using the paired *t*-test. Statistical significance was accepted at $p < 0.05$.

Results

Results indicated five of the six subjects significantly increased their 400m speed 0.05-0.15 m/s. Only one subject showed no improvement (-0.19 m/s). In the two interval training sessions' (Tr-1, Tr-3) blood lactate concentration indicated a downward trend post test and in the 6th interval of each training session a significant difference occurred ($p<0.05$). NH_3 in 6th interval training and in the 3rd min of rest (E3) decreased significantly ($p < 0.05$), after 3 days of training H_2O_2 indicated no significant change ($p>0.05$). While looking at heart rate during interval training, Tr-1 and Tr-3 indicated a downward trend.

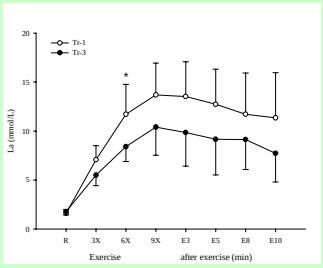

Figure 3: Lactate during the 1st (Tr-1) and 3rd day (Tr-3) of training including recovery time (E)

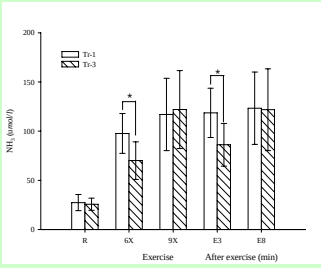

Figure 4: NH_3 during the 1st (Tr-1) and 3rd day (Tr-3) of training including recovery time (E)

Table 3: H_2O_2 and Heart Rate during the 1st (Tr-1) and 3rd day (Tr-3) of training including recovery time (E)

		R	E5	E8	
H_2O_2 (mmol/l)	Tr-1	1.71±0.35	1.88±0.47	1.85±0.45	
	Tr-3	1.59±0.41	1.81±0.36	1.86±0.39	
		3X	6X	9X	E5
HR (min^{-1})	Tr-1	187.33±9.54	191.5±10.48	193.83±10.25	111.33±14.02
	Tr-3	177±12.68	183.83±11.51	187.33±12.93	101.33±17.63

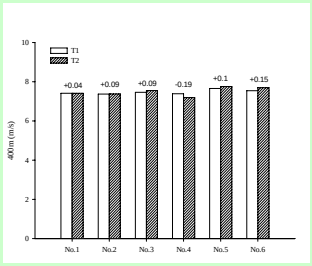

Figure 5: Individual results of 400 m pre-test (T-1) and post-test (T-2)

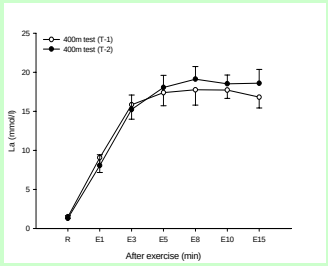

Figure 6: Comparison of lactate (mmol/l)

Discussion

In this study, lactic acid and NH_3 showed a downward trend (Tr-1 vs Tr-3), under high-intensity exercise with hyperoxia, that PCr have better efficiency (stellingwerff et al., 2006), and relative lower production of blood lactate (Hollmann et al., 2002; Jang, 2003; Huang, 2008). In this study H_2O_2 indicated no significant change which was different from Cooper et al (2002) findings. This could possibly be caused by antioxidants (Muna et al., 2001) and HSP70 (Kinnunen et al., 2005) but in order to better understand this, further research would need to be conducted. Heart rate and 400 m speed performance were not significantly improved. This indicated that more time to adapt is required.

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