HONG KONG SPORTS INSTITUTE 香港體育學院

RESEARCH HIGHTLIGHTS

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Biomechanical Monitoring of Mountain Bike Training

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Introduction

Mountain biking athletes are frequently required to ride for more than two hours on steep trails during competitions. Climbing them successfully requires athletes to possess superb technical skills. Thus, from a biomechanics perspective, an athlete must master the set of specific skills and techniques required to cope with bike trails with high difficult ratings. The 2010 Guangzhou Asian Games mountain bike race trail was used as a case study.

Research Objective

Specific training provided for the Hong Kong athlete participated in the 2010 Guangzhou Asian Games mountain event was monitored from a biomechanics perspective. The objective of the study was to monitor the bike specific training and hence to improve athletes' specific skills, effectiveness of training, and adaptation of athlete to a specific race course.

Research Methodology

In this study, SRM (Schoberer Rad Messtechnik power measurement equipment) was used to collect data in respect to athlete's specific skills used to ride this specific race course [1]. SRM is a widely used measuring instrument to measure power, speed, cadence, heart rate, ambient temperature and altitude during ride. The 2010 Guangzhou Asian Games mountain bike race course was a 5 km circular course with 3 main uphill and downhill sections in each lap, and athletes were required to complete 8 laps. The distance of the course and the change in hillside slopes were measured using the GPS (Global Positioning System) 3 months before the competition. In addition, SRM was used to understand Hong Kong athlete's specific skills featured during a high intensity and high speed training session. Based on these data, the specific skill pattern requirement for this course was mapped out [2]. The requirement were further refined to let the athlete make breakthrough of existing ability using interval training under coaches' advice.

Result and Discussion

Table 1:Power, cadence and force data under different uphill sections.

Section	Altitude (M)	Time (Min:sec)	Power (W)	Cadence (Revolutions/ min)	Pedalling Force (kg)
Uphill 1	98-120	4'37"	359.7	84.0	23.9
Uphill 2	108-150	5'39"	290.7	73.7	22.0
Uphill 3	128-138	0'55"	321.9	64.0	28.0
Average			324.1	73.9	24.6

Table 1 shows that the average power, average pedalling force and average cadence were 324W, 24.6 kg and 73.9 revolutions/ min respectively. The time used to ride Uphill 1 was 4 minutes and 37 seconds; that for Uphill 2 was 5 minutes and 39 seconds; and 55 seconds for Uphill 3. As a result, the kinematics and kinetics data was collected for all the uphill section in the race course. From a biomechanics perspective, the specific skill of an athlete is expressed through his cadence and pedalling force, and the two corresponding outcomes: pedalling power and bike speed [3-5]. To a mountain biking athlete, the specific ability expressed on the uphill section is the key factor in the race. After obtaining the specific skill pattern requirement of the 2010 Guangzhou Asian Games mountain bike race course, a three-month training programme was provided to athletes under coaches' advice with the aim to strengthen athlete's specific skills and assist them to adapt to the intensity required for this competition. In the training, athlete was trained on BT (bike resistance training instrument) in multiple sets for 1-5 minutes/set with 350 - 400W for power, 30 - 35kg for pedalling force, and 70 - 80 revolutions/minute for cadence. Athlete spent more training hours on BT than on the race course during the preparation period. As a result, at the 2010 Guangzhou Asian Games, the Hong Kong athlete outputted on average 292.8W for power, 24kg for pedalling force and 68.4 cycles/minute for cadence in the uphill sections. These abilities ensured him to beat high level athletes from Japan, Korea and China and won his first championship in Asian competition.

Conclusion and Recommendation

This study shows that mountain biking athlete's performance can be significantly improved with bike specific training monitoring according to the profile of the racing trail. The crux of specific training is to develop firstly an athlete's basic, all-rounded skills, then to fully develop his specific skill. In this study, the monitoring method used to monitor specific skills of mountain biking athlete focuses on four main areas:

(1) collect the athlete's specific skill data demonstrated in the high-intensity trainings which met the competition requirements; (2) analyse the difference in specific skill data between Hong Kong athlete and high-level athletes; (3) plan out the specific skill requirement to improve athlete's specific skill; and (4) monitor the athlete performance during training to ensure the training programme is effective.

References

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