Persistent Fatigue in a Female Sprint Cyclist After a Talent-Transfer Initiative

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Heavy training loads combined with other life stressors and inappropriate recovery can lead to persistent fatigue in athletes.¹ Mechanisms explaining the etiology of persistent fatigue in athletes (such athletes are often referred to as overtrained athletes) are available and frequently discussed in the scientific literature; however, documentation of athletes with persistent fatigue is rare.² The majority of research examining persistent fatigue has focused on endurance athletes. We are unaware of research documenting persistent fatigue in athletes who specialize in events lasting less than 1 minute.³ To avoid confusion with other definitions of fatigue we have used the term persistent fatigue to describe the inability to perform a familiar exercise task, despite more than 3 weeks of recovery. The term persistent fatigue does not attribute cause to the condition (ie, inappropriate training, diet, or recovery) and reflects fatigue so severe that performance is lower than a baseline untrained level.

We had a unique opportunity to monitor an athlete who experienced persistent fatigue after being introduced to sprint cycling. After developing fatigue, this cyclist moved to the Australian Institute of Sport (AIS) and was monitored by a multidisciplinary team including a medical doctor, a recovery specialist, a physiologist, a talent-identification specialist, a psychologist, a dietician, and a physiotherapist. The primary aims of this case study are to describe the conditions that preceded the development of persistent fatigue, outline the management approach for this fatigued athlete, and document the response to the recovery intervention.

Methods

Athlete History

A 26-year-old female alpine skier with 5 years of international racing experience in the super giant slalom and downhill events displayed an exceptional ability to produce power during a cycle ergometer 30-second sprint and was subsequently identified as one of 26 women with the potential to excel in the track cycling 500-m time-trial event. The athlete gave written permission for her data to be published in this format.

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Talent-Identification Training Program

The 6-week training program required athletes to engage in resistance training (3 days per week) and cycling standing starts (<10- to 15-second efforts, 2 to 3 days per week). After 3 weeks, resistance training was maintained; however, sprint training on the track was changed to flying sprints of a longer duration (10 to 30 seconds).

Training After Talent Identification

After the 6-week training program, the athlete began to train with a local cycling club and adopted a higher volume of cycle training (4 to 6 days per week), a higher volume of resistance training (3 to 4 days per week), and weekly racing. During this period the athlete was working long hours and was not eating or sleeping consistently (<6 hours per night sleep, including shift work). Despite the suboptimal sleeping and eating behavior, sprint track cycling performances over the subsequent 6 months improved. Unfortunately, cycling performance eventually began to decline, and the athlete reported feeling fatigued and underperforming on the track.

AIS Review

Approximately 1 year after being introduced to track cycling the athlete met with members of the AIS support team for a thorough assessment of factors related to fatigue. Her attendance at the AIS occurred after 2 months of unsuccessful visits to a variety of health-care professionals who had not been able to determine the underlying cause of her fatigue.

Recovery Strategy

The support team first established that there was a performance decline in addition to very high perceptions of fatigue. A recovery program was then designed that initially focused on establishing consistent sleeping and eating patterns. The athlete moved into an ideal sleeping environment (quiet, cool, and dark) where she would not be disturbed and sleep duration could be monitored. Once sleep and diet goals were met, the athlete began to participate in low-intensity noncycling exercise (walking and swimming). Exercise duration was short (<30 minutes daily), and increments in weekly exercise duration were subtle. Once a daily training load of 60 minutes of low-intensity noncycling exercise was achieved, a low-force, high-velocity resistance-training program was initiated.

Monitoring Recovery

While at the AIS, the athlete routinely met with a sport psychologist (1 to 2 sessions per week) and participated in various recovery strategies once per week (eg, floatation tank, massage, hydrotherapy). During this time the athlete completed a diary, which consisted of a sleep log, the Daily Analysis of Life Demands of Athletes, and the abbreviated version of the Profile of Mood States. For the 3 months the athlete lived at the AIS, she did not participate in any cycling exercise.
Results

Medical Review
The AIS medical practitioner determined that the athlete had no history of illness that might have predisposed her to persistent fatigue. Clinical examination, electrocardiography, full blood count, hepatitis serology, and biochemical screen were normal. Compartment syndrome and iliac arteriostenosis were not present.

Fitness Assessment
Within 2 weeks of arriving at the AIS, the athlete completed a battery of fitness tests. The mean power during a maximal 30-second sprint test was reduced by 23% from baseline values obtained when unconditioned and not fatigued, that is, before sprint cycling training began (see Figure 1).

Training Volume
The athlete gradually increased training duration (Figure 2[a]) from 30 minutes per day 5 times a week to approximately 150 minutes per day 6 times per week during the AIS recovery period. Over this same period, intensity (perceived exertion) increased from 1.0 to 8.5 (on a Borg scale of 1 to 10; Figure 2[b]).

![Figure 1 — Maximum mean power (SD) for 30 seconds quantified on 5 separate occasions. The 30-second cycling sprint test was performed on a wind-braked cycle ergometer before (T1), during (T2), and after (T3) a supervised 6-week track sprint-training program and then before (F1) and after (F2) a 3-month recovery program. Power output was quantified using a dynamically calibrated SRM power crank (8 strain gauge) at 5 Hz. The average power output (solid horizontal line) with the 90% confidence limits (dashed line) for the first 3 tests was 560 ± 59 W. The reduction in maximum mean power for 30 seconds was ~23% in the fatigued state (F1).](image-url)
Figure 2 — (a) Duration of training, (b) perception of effort, (c) responses to Daily Analysis of Life Demands of Athletes Part A questionnaire, and (d) Profile of Mood State during the treatment period (5 months). A linear regression was used to highlight the overall trend observed for these variables over a 5-month period including the initial 3-month period spent at the Australian Institute of Sport.
Sleep Hygiene and Mood Assessment

Hours of sleep and number of nighttime wakings remained unchanged during the recovery period; however, the athlete was no longer working late into the evening. Part A of the Daily Analysis of Life Demands of Athletes questionnaire showed a reduction during the recovery period, indicating a reduction in the sources of stress experienced by the athlete (Figure 2[c]). Similarly, total Profile of Mood States scores decreased over time, primarily because of perceptions of less fatigue and more vigor (Figure 2[d]).

Summary

Limited sleep, multiple life stressors, frequent high-intensity training, and exceptional motivation were simultaneously occurring in a talented female sprint cyclist who developed persistent fatigue. In this case study nearly 3 months without intense training were required before sprint cycling performance returned to untrained baseline values. A novel aspect of this case study is the documentation of cycling sprint performance when the athlete was untrained. These data indicate that the fatigue was so severe that this athlete could not perform at a level she was previously capable of in an untrained state. The recovery approach used in this study focused on a thorough medical review, establishing a consistent sleeping pattern (8 to 10 hours per night), establishing desirable eating patterns, a gradual increase in low-intensity noncycling activities, and a cautious introduction to circuit weight training and exercise intensity. In this case study, it appears that the athlete had completely detrained to baseline fitness values by the time she was fatigue free (~3 months).

References