Monitoring Progress in Professional Cycling: From Submaximal Testing to the Use of Field Data

Over the past few decades, many elite sport teams have established a close working relationship with sport scientists. This phenomenon has given rise to the so-called embedded scientist, a person who hails from a scientific background and who, as part of a team, plays an integral part in assisting and improving athletes' training status and performance. The embedded scientist, guided by the latest available scientific knowledge, monitors athletes' progression and training load.

Previously, the majority of teams and athletes were hesitant about sharing data with individuals outside their immediate training group and the embedded scientist, but this is slowly changing. Today, it is more common that teams with embedded scientists work alongside university-based sport scientists. These collaborations, which are based on mutual trust and a benefit for both parties, have changed the scientific support basis from a single person to a scientific support team. In addition, these collaborations have led to unique publications on highly elite athletes, which have added valuable information to the body of knowledge in sport science.

Technological developments have made it possible to quantify training load more precisely, with the number of tools available to do this growing exponentially over the last 10 years. In professional cycling, the training status of a cyclist was traditionally monitored based on a set of standardized performance tests (eg, peak power output, Wingate test, and/or a 20- or 40-km time trial) and subjective feedback from the athlete. Today, most cyclists are monitored by continuous submaximal monitoring programs, as well as field data. While a submaximal test such as the Lamberts and Lambert submaximal cycle test¹ uses the response to a standardized load to monitor cyclists, field data provide valuable insight on how a cyclist copes in a training or racing environment, which includes the impact of multiple factors, such as the terrain, environmental conditions, and accumulation of fatigue.²

Besides being able to track changes over time, a monitoring tool should be able to reflect a state of functional overreaching so that a healthy balance between training load and recovery can be restored. A recent systematic review by Roete et al³ showed that the Lambert submaximal cycle test is able to reflect the state of functional overreaching by an increased power output and rating of perceived exertion at the same submaximal heart rate alongside a more rapid heart recovery. In line with this, Sanders et al⁴ reported decreased heart rates, as well as increased power output and ratings of perceived exertion, with the progression of stages during a Grand Tour in 12 professional cyclists. It is important to note here that the responses are counterintuitive and may be interpreted as a positive training response, which may lead to wrong decision making without the knowledge of other markers and the training/

racing load. This highlights the importance of employing a multifactorial monitoring approach. Altogether, this highlights the complementary potential of combining submaximal testing and field data when monitoring athletes.

A highly successful conference at which the latest development in monitoring training load was discussed and debated was organized by the Aspire Academy in Doha in 2016.⁵ The *Monitoring Athlete Training Loads—The Hows and Whys* conference not only reached over 1.36 million Twitter followers under the hashtag #TrainingLoad2016,⁵ but also resulted in the highest-cited *IJSP* supplement (2017, Vol 12, suppl 2). As the development of monitoring tools and scientific insights are progressing continuously, the necessity for a second edition of this conference is growing already, 5 years later.

This editorial provides insights into the present practice and future possibilities of monitoring athletes, while highlighting the value of submaximal testing, the use of field data for athletes, and the combination thereof. In addition, it shows how unique collaborations between professional athletes/teams and researchers can be beneficial for both coaches and athletes, as well as result in novel scientific publications in journals like *IJSP*.

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