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Conference abstract

External and Internal Load Variations in Professional Male Cyclists during a 14-day Training Camp

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Abstract: Professional athletes take part in training camps during specified periods of a season aiming to optimize training adaptations and in preparation for competitions. To improve performance and avoid overtraining it is crucial to find the right balance between training and rest. However, an intensified training period may result in overreaching. This study investigates internal and external training load parameters among 26 male professional cyclists during a 14-day training camp. Various metrics, including average power, distance, duration, fatigue, session-RPE, and training load, were measured and compared between the first and the second phase of the training camp. The second part showed increased values for these parameters, indicating heightened training intensity. Interestingly, sleep improved during the latter phase, and overall wellbeing remained unaffected. These findings may contribute to the field of professional cycling with valuable insights into the multifaceted aspect of athletes' performance and wellbeing during a training camp.

Keywords: Cycling, External, Internal, Professional, Training Camp, Training Load

1. Introduction

Due to the nature of professional cycling, a sport that involves a large volume of training sessions and competitions, cyclists are exposed to high physiological and psychological demands (Lucia et al., 2001). To improve performance and avoid overtraining it is crucial to find the right balance between training and rest. Therefore, training monitoring is a key factor of coaching. Aiming to optimize training adaptations, such as getting ready for a competition, professional athletes take part in training camps during specified periods of a season (Saw et al., 2018). However, an intensified period of training could lead to overreaching (Halson et al., 2002). The aim of the study was to investigate internal and external training load parameters in professional cyclists during a training camp.

2. Materials and Methods

2.1. Subjects

26 male professional cyclists took part in the study. According to the Participant Classification Framework (McKay et al., 2021) participants were Tier 4 (Elite/Professional Level).

2.2. Methodology

A training camp was held from 05/12/2022 to 18/12/2022, participants were asked to complete a subjective wellness scale in the morning, followed by rating session-related perceived exertion (session-RPE) at the end of each training session. Training camp was divided into two microcycles of seven days each (M1, M2).

2.3. Subjective Wellness Scale

The scale was adapted from Hooper et al., (1995). Using a 5-point Likert Scale (1: highest

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value of wellness; 5: lowest value of wellness), items assessed were: fatigue; sleep; muscle soreness; mood; and stress. In the morning, participants logged their responses using their own smartphones via an online questionnaire. Additionally, a wellness index (WI) was calculated as the sum of all the items.

2.4. Session-RPE

Participants recorded their session-RPE (sRPE) using the modified CR-10 scale (Foster et al., 2001) at the end of each training session via their own smartphones and an online questionnaire.

2.5. Training-related parameters

Heart rate (HR, Bryton heart rate monitor, Bryton Inc, Taipei City, Taiwan) and power output data (Favero Assioma Duo, Favero Electronics srl., Arcade, TV, Italy) were recorded using the same cycle computer (Bryton S800, Bryton Inc, Taipei City, Taiwan), and analysed using WKO5 Software (WKO5, Peaksware LLC, Lafayette, CO, USA). Training load (TL) was calculated as training duration (in minutes) multiplied by session-RPE.

2.6. Statistical Analysis

Due to the ordinal nature of the wellness data, Medians (Mdn) and interquartile ranges (IQR) were reported. Wilcoxon signed-rank tests were used to investigate difference between microcycles (M1, M2). Effect sizes (ES) were calculated as matched biserial correlations. Values greater than 0.1, 0.3, and 0.5 depict small, intermediate, and strong effects, respectively (Cohen, 1988). Statistical analyses were performed using JASP 0.18.3 (JASP, Amsterdam, Netherlands). Statistical significance was set at $p < 0.05$.

3. Results

Compared to M1, the following variables were higher in M2: fatigue (p = 0.030; ES = 0.51); session-RPE (p < 0.001; ES = 0.81); training load (p = 0.015; ES = 0.54); duration (p = 0.025; ES = 0.50); distance (p < 0.001; ES = 0.71); and average power (p < 0.001; ES = 0.95). Sleep was better in M2 than in M1 (p = 0.014; ES = 0.58). No significant differences were found between M1 and M2 for: muscle soreness (p = 0.101); stress (p = 0.128); mood (p = 0.439); wellness index (p = 0.094); elevation gain (p = 0.600); and average heart rate (p = 0.745). Full disclosure of the results can be found in Table 1 and Table 2.

Table 1. Internal training load variables. Results are shown as Median (Interquartile range). M1 = Days 1 to 7; M2 = Days 8 to 14. ES = Effect size. * denotes significant differences between M1 and M2.

Item	M1	M2	p	ES
Fatigue (1-5)	15 (4)	16 (4)	0.030*	0.51
Sleep (1-5)	15 (8)	13 (8.5)	0.014*	0.58
Muscle soreness (1-5)	13.5 (6.75)	15.5 (4)	0.101	0.38
Stress (1-5)	14 (4.75)	13.5 (8.75)	0.128	0.38
Mood (1-5)	12.5 (8.75)	14 (4)	0.439	0.20
Wellness Index (A.U.)	73 (31)	73.5 (24.8)	0.094	0.39
sRPE (0-10)	31.5 (12.8)	32.5 (10.3)	<0.001*	0.81
Training Load (A.U.)	7139 (3181)	7604 (1697)	0.015*	0.54

Table 2. External training load variables. Results are shown as Median (Interquartile range). M1 = Days 1 to 7; M2 = Days 8 to 14. ES = Effect size. * denotes significant differences between M1 and M2.

Item	M1	M2	p	ES
Duration (min)	1290 (93)	1378 (176)	0.025*	0.50
Distance (km)	635 (51)	717 (93)	< 0.001*	0.71
Elevation gain (m)	8204 (802)	8213 (1570)	0.600	0.12
Average heart rate (bpm)	129 (9)	129 (8)	0.745	0.08
Average Power (W)	178 (12)	189 (13)	< 0.001*	0.95

4. Discussion

In comparison with the first block of the training camp (M1), several parameters of external and internal training load were higher in the second part (M2). Average power, distance, duration, and training load, intentionally, as a potential consequence of the training camp plan. Fatigue and session-RPE could be the most sensitive internal factors during an intensified period of training. Athletes' wellbeing, measured as WI, seems not to be affected by a 14-day training camp. Interestingly, sleep was better during the second half of the training camp.

These findings may contribute to the field of professional cycling with valuable insights into the multifaceted aspect of athletes' performance and wellbeing during a training camp.

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Conflicts of Interest: The authors declare no conflict of interest.

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