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Interactions between emotions, sleep and the autonomic nervous system in high-level female cyclists: effects of hypoxia

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INTRODUCTION:
"Living High-Training Low and High" (LHTLH) is an altitude training method used by high-level athletes for its positive effect on performance [1]. However, as any hypoxic method, it may alter sleep [2] and heart rate variability (HRV) [3]. Whereas intense emotions impair sleep in normoxia [4], This remains unclear in high-level athletes, particularly during LHTLH. Therefore, the aim of this study was to determine the possible relationships between sleep, HRV and the feelings during training (FDT) in high-level cyclists before or after 14 days of LHTLH.
METHODS:
Ten high-level female track cyclists (age: 17,3 ± 1,2 year; BMI: 22,5 ± 2,1 kg.m2; VO2 max: 54 ± 6.9 ml.min.kg-1) were invited during 5 days to train in normoxia followed by 14 days of LHTLH in normobaric hypoxia, simulating 2800m altitude. During LHTLH, they spent ~14 h per day in hypoxia and performed endurance and repeated sprint training between 150 to 2800 m. Before (in normoxia) and during LHTLH, morning HRV and sleep (sleep efficiency, NREM1, NREM2, NREM3, REM) with EEG head band (Dreem®), as well as sleep disturbance (Groeningen) and night peripheral oxygen saturation were monitored. From 5 days before and during LHTLH, the participants were asked to record their FDT with different questionnaires: Telic State Measure [5], Sport Grit Scale [6] and Mental Toughness [7]. A Pearson correlation coefficient was used to determine possible relationships between sleep, HRV and FDT. Firstly, we observed the effects of sleep on HRV and on FDT of the next training session. Secondly, we analyzed the effects of FDT on sleep the following night and HRV. Statistical significance was set at $P < 0.005$.
RESULTS:
In normoxia, no significant relationship was observed between sleep, HRV and FDT. However, during the first 4 days of LHTLH, we observed i) a negative influence of sleep on FDT with a significant correlation between REM and the preferred arousal ($r = -0.85$, $P<0.005$); ii) a negative and a positive influence of FDT on HRV or sleep with a significant correlation between goal reaching in training and HRV (RMSSD) ($r = -0.90$; $P<0.005$) and between mental toughness and sleep efficiency ($r = 0.81$; $P<0.005$), respectively.
CONCLUSION:
Our results suggest that LHTLH produces a bidirectional relationship between sleep, HRV and FDT; that is not observed in normoxia. On the one hand, during the first days in hypoxia a degradation of sleep structure may increase the negative emotions during the following training session. On the other hand, FDT may positively or negatively impact the sleep structure and HRV during the following night. Overall, our results suggest that LHTLH exacerbates emotions, particularly during the first days in hypoxia. These finding are of practical interest for coaches to optimize athletes' training and recovery in hypoxic environment.

1. Brocherie et al., (2015) 2.Roach (2013) 3.Schmitt et al. (2018) 4.Vandekerckhove & Wang (2017) 5.Svebak & Murgatroyd (1995) 6.Clarck & Malecki (2019) 7.Gucciardi et al. (2014)

Topic: Coaching

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