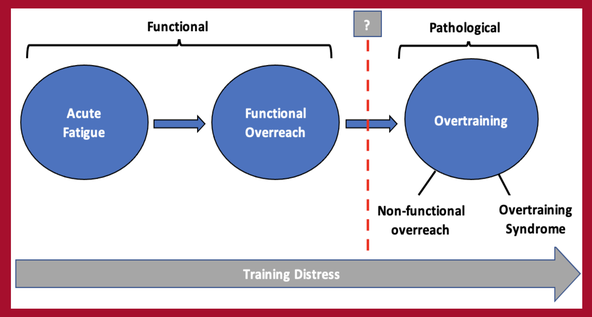
SLEEP PATTERNS OF RECREATIONALLY ACTIVE ADULTS THROUGHOUT A THREE-WEEK HIGH-INTENSITY OVERREACHING TRAINING PROTOCOL.

Thomas Gooding, Ian Rasmussen, Amanda Lamp, Hans Haverkamp

Occupational Sleep Medicine Group, Sleep and Performance Research Center, Department of Translational Medicine and Physiology, Elson S. Floyd College of Medicine, Washington State University

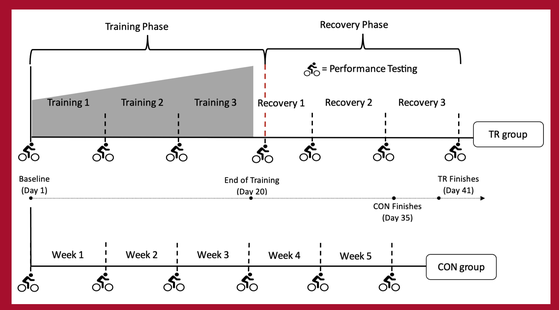
Background:

- **Overtraining is a maladaptive training response** caused by excessive training stress and/or inadequate recovery.
- The hallmark symptom of overtraining is an unexplained reduction in performance. Secondary symptoms can include worsened mood states, higher incidence of illness, and neuroendocrine dysfunction.
- Sleep, athletic performance, and immune system function share bi-directional relationships with one another.
- Overtrained individuals often report sleep disturbances; however, it is unclear whether poor sleep contributes to overtraining progression or is merely a symptom.



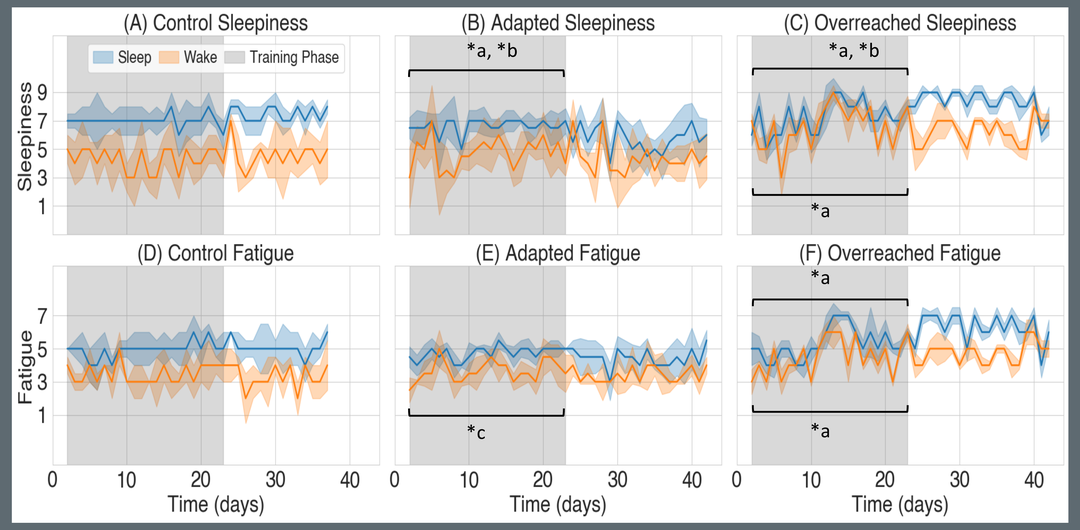
Methods:

- Study participants were randomized into a training group (TR, n=11) or control group (CON, n=9). The TR group underwent a three-week high-intensity training protocol, followed by three weeks of recovery.
- Sleep was measured using actigraphy and paired sleep diaries. Illness symptoms were assessed using the Wisconsin Upper Respiratory Illness Symptoms Score (WURSS-11).
- After training, three TR participants were considered overreached (**OR**), evidenced by a decrease in performance (-10.38 ± 5.55% from baseline); other TR participants (n=8) were considered adapted (**AD**).



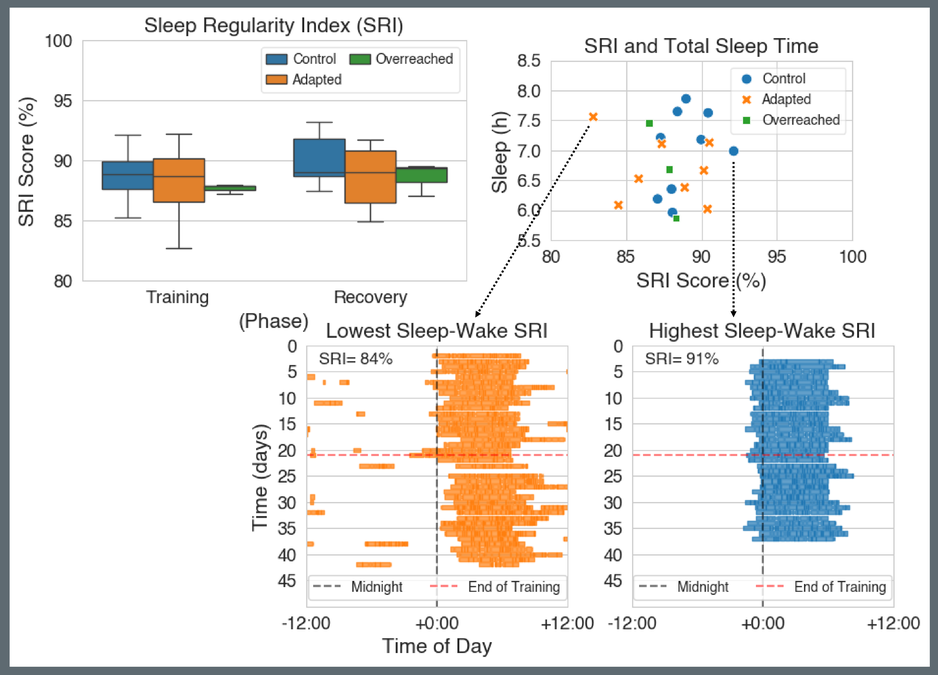
During intensified training, **overtrained individuals experience:**

- ***Excessive* subjective fatigue and sleepiness**
  — both at bedtime and upon waking;
- ***Increased* illness symptoms.**



Group differences over time were assessed using linear mixed-effects models. *a indicates group·time interaction with the CON group during the same phase; *b indicates group·time interaction with the AD group during the same phase; *c indicates a within-group main effect of time during the specific phase. Upper brackets indicate group differences at bedtime; lower brackets indicate group differences upon waking. Data reported as median + interquartile ranges.

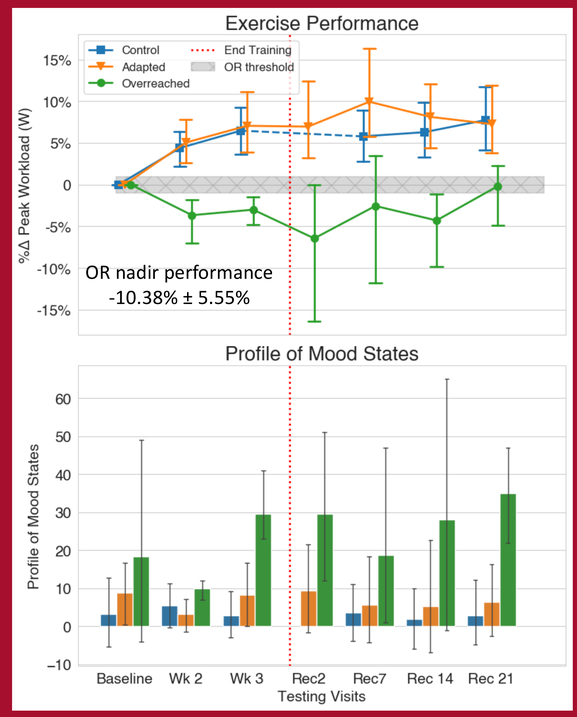
Intensified training **does not appear** to affect sleep regularity.

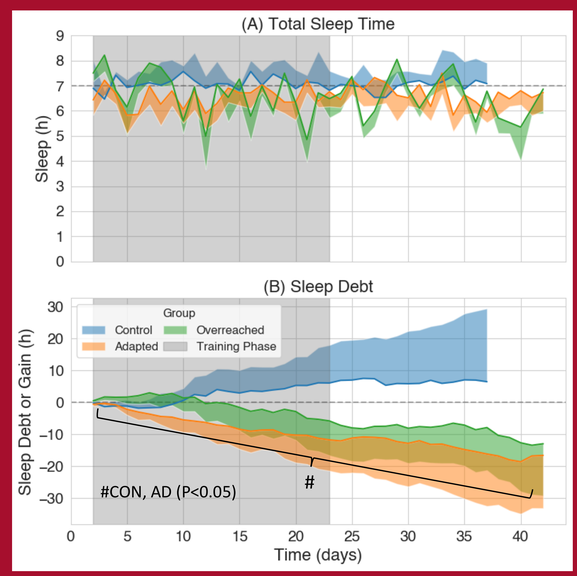


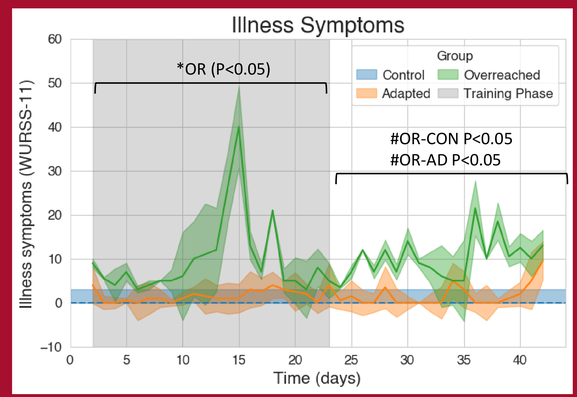
Download Poster + Abstract

Connect on LinkedIn

WASHINGTON STATE UNIVERSITY







Full Abstract

The purpose of this study was to investigate how chronic, high-intensity exercise affects sleep characteristics–including total sleep time (TST) and sleep regularity–in healthy, moderately active adults. **Methods:** Twenty healthy, recreationally-active adults were randomized into training (TR, n=11) or control (CON, n=9) groups. TR participants underwent a three-week training protocol designed to induce short-term overtraining (overreach, OR) under laboratory conditions, followed by a three-week recovery phase. Sleep was measured daily using actigraphy and paired sleep diaries. Exercise performance was measured weekly (graded exercise test, cycle ergometer). Illness symptoms were assessed using the Wisconsin Upper Respiratory Illness questionnaire. **Results:** After training, three TR participants were classified as OR (-10.38% ± 5.55% decrease in performance, increased profile of mood state scores); TR participants without decreased performance were categorized as adapted (AD, n=8). Across all visits, median TST was similar among the three groups (CON: 7.18 [6.44–7.46]) $h \cdot night^{-1}$; AD: 6.49 [6.29–7.05] $h \cdot night^{-1}$; OR: 6.72 [6.36–7.03] $h \cdot night^{-1}$, respectively, $P>0.05$). However, compared to the CON group ($\beta=0.023$ $h \cdot night^{-1}$, $P=0.517$), both the AD group and the OR group accumulated sleep debt throughout both the training and recovery phases ($\beta=-0.306$ $h \cdot night^{-1}$, $P<0.001$; $\beta=-0.355$ $h \cdot night^{-1}$, $P<0.001$, respectively). The OR group exhibited progressive, concomitant increases to fatigue and sleepiness, both at bedtime and upon waking, compared to CON and AD groups ($P<0.05$), and increased illness symptoms during both the training and recovery phases ($P<0.05$). There were no group differences detected in any sleep regularity measures ($P>0.05$).

Conclusions: Chronic high-intensity exercise may impact an individual's ability to achieve sufficient sleep, resulting in the accumulation of sleep debt. However, high-intensity does not appear to affect sleep regularity. OR individuals may experience persistent increases in sleepiness and fatigue. Increased illness symptoms in OR participants in the absence of sleep differences between AD and OR groups suggests that immune system function plays a key role in the progression of overtraining.