



A PRACTITIONER'S GUIDE TO IMPROVING SLEEP IN ATHLETES

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KEY POINTS

- Athletes are at a higher risk for sleep problems due to lifestyle and sports-related factors, and frequently suffer from sleep-related complaints.
- There are sleep strategies for practitioners and coaches to emphasize that can help improve athletes' sleep and performance.
- Recurring sleep education and screening for sleep disorders in athletes can highlight the importance of sleep and identify athletes in need of referral to a sleep specialist.
- Increasing sleep opportunities by napping and banking sleep, when possible, can help ensure that athletes are getting the sleep they need.
- Preparing the environment, body, and mind for sleep by promoting good sleep practices can help reduce sleep complaints and improve overall sleep.

INTRODUCTION

Sleep is an important physiological process that allows an athlete to recover from the mental and physical demands of the sport. It is an often-overlooked aspect of athlete health that can have a huge impact on athletic performance. For example, in male basketball players that extended their sleep from 6.7 to 8.5 h of sleep per night, athletic performance was improved for free throws (11%), three-point shots (14%), sprint times (4%), and reaction time (12%) (Mah et al., 2011). Other potential reasons why sleep is important for an athlete are related to improvements in physical health with a reduction in stress hormones (Swinbourne et al., 2018), increases in testosterone with sleep extension (Leproult & Van Cauter, 2011), and decreased risk for injury (Grier et al., 2020), and illness (Prather et al., 2015).

Yet there are challenges with sleep in athletes and they appear to be widespread making sleep improvement strategies especially important. When compared to control participants, athletes took longer to fall asleep, spent more time awake during the sleep period with less overall sleep, had greater use of sleep medication, and had greater sleep fragmentation (Bender et al., 2018; Leeder et al., 2012). Reasons for greater sleep challenges are related to both non-sport factors such as social demands, work/study commitments, attitudes & beliefs, lifestyle choices, individual characteristics, and family commitments; and sport factors such as high training loads, unfamiliar sleep environment, early morning training, night competitions, night before competition anxiety, and long-haul travel (Walsh et al., 2020).

Not only is the increased risk for sleep disturbance high in athletes, but practitioners can also have difficulties applying sleep strategies to their athletes for multiple reasons as sleep myths seem to be pervasive (Robbins et al., 2019), there is a lack of sleep education among athletes (Miles et al., 2019), and inadequate beliefs and attitudes about

sleep abound (Miles et al., 2019). While there are many challenges to overcome, this Sports Science Exchange (SSE) article examines strategies that can be implemented for athletes to improve sleep health and performance.

RESEARCH REVIEW INTO SLEEP STRATEGIES

There has been a surge in research related to sleep in athletes with 82% of papers on the topic published since 2011 (Lastella et al., 2019). Yet, it is challenging for busy practitioners to ascertain what information is worth implementing. Walsh et al. (2020) provided a narrative review and consensus recommendations, complete with a toolbox, to help practitioners implement sleep strategies in athletes. Here we highlight some of those strategies along with other important strategies to consider.

EDUCATE ATHLETES FREQUENTLY ABOUT THE IMPORTANCE OF SLEEP

In a sample of 86 coaches and practitioners, Miles et al. (2019) found only 43% of the sample had promoted sleep hygiene with their athletes in their current job position, with one of the main barriers being lack of sleep knowledge. Sleep education programs can result in positive changes in sleep behaviors including more consistent sleep schedules, greater sleep efficiency, and shorter sleep latency (Driller et al., 2019). However, a one-time sleep education session is likely not enough to maintain long-term positive change in sleep habits so more emphasis throughout the season is needed (Caia et al., 2018).

Regarding the content of the sleep education information, a good place to start is how better sleep could result in better performance for the athlete to help create buy-in from the athletes. According to Walsh et al. (2020), content can focus on quantity, quality, and timing of sleep.

SLEEP QUALITY

Athletes are more at-risk for sleep disturbances so having strategies to help mitigate the disturbances is critical for better sleep quality. Strategies related to reducing evening light exposure, having a good pre-sleep routine, a cave-like environment, and drinking caffeine strategically can all help improve sleep quality for athletes. See the following section for more detail on Good Sleep Behavior Practices to incorporate into education sessions.

SLEEP TIMING

Chronotype is the biological preference for being an evening type or a morning type and is related to the timing of melatonin secretion which changes across the lifespan. In general, evening types are more common in adolescents and peak in late teens to early twenties (Roenneberg et al., 2004). Although previous research has shown that athletes are more likely to be morning types, those who are night owls struggle more with their sleep (Bender et al., 2018a). There are also advantages to training according to chronotype. For example, evening types who compete or train in the morning often feel sleepier, are less vigilant, and have worse cognitive performance and grip strength (Facer-Childs et al., 2018).

SCREEN ATHLETES FOR SIGNIFICANT SLEEP PROBLEMS

Although sleep optimization through sleep hygiene tips can improve some common sleep complaints, having an undiagnosed sleep disorder can prevent an athlete from getting the recovery sleep they need to perform at the highest level. It is not the role of the practitioner to diagnose an athlete with a sleep disorder, but rather to help identify when athletes need to be referred to a specialist.

There are several ways to screen athletes for sleep problems including polysomnography (a sleep study to diagnose sleep disorders), clinical sleep interviews, wearable technology, and sleep questionnaires. It would be nice if every athlete could get an official gold-standard sleep study using polysomnography, but that can be time-consuming, economically prohibitive, and unnecessary. Questionnaires can provide a way to capture a wide range of sleep problems in a standardized way. The Pittsburgh Sleep Quality Index is often used in the general population to identify concerns with sleep quality but has not been validated in athletes to identify clinically significant sleep disturbances. The Athlete Sleep Screening Questionnaire (ASSQ) was developed to help identify athletes who need intervention from a sleep specialist (Bender et al., 2018b). The ASSQ categorizes athletes' sleep difficulty into none, mild, moderate, or severe sleep difficulty with moderate and severe needing help from a sleep specialist. Additionally, it includes recommendations based on responses to items, such as travel, risk of sleep apnea, and having an evening chronotype. Using this questionnaire, approximately 25% of elite athletes are identified as requiring intervention (Bender et al., 2018b). Athletes can access the ASSQ on the Centre for Sleep and Human Performance website (<https://centreforsleep.com/education-and-awareness/athlete-sleep-screening-questionnaire/>). It is recommended that sleep screening is done during the non-competitive

season when there is time to address the sleep problem without drastic changes during the competitive season.

IMPLEMENT NAP OPPORTUNITIES

Daytime naps can be beneficial for supplementing insufficient sleep or extending sleep. There is a range in the frequency of napping reported across studies, with 17 – 72% of athletes reporting habitual napping (Lastella et al., 2021; Stephenson et al., 2022; Venter et al., 2010). Napping after poor sleep has been associated with improved vigilance, reasoning, alertness, and reduced reaction time (Milner & Cote, 2009). Improvements in reaction time have been found in several different types of athletes when napping on competition days, including karate athletes (Daaloul et al., 2019), and judokas (Romdhani et al., 2021). Beyond cognitive performance, napping also carries benefits for mental health and for physical recovery and performance (Lastella et al., 2021). Across studies, athletes have shown improvements in jump velocity (O'Donnell et al., 2018), physical power and sprinting (Romdhani et al., 2021), and generally better performance ratings by coaches (O'Donnell et al., 2018).

As many athletes may struggle to get a good night of sleep before a big competition or need to wake up early for travel or training, a nap offers the opportunity to recover some of the benefits of lost sleep. However, it is important to consider both the timing and duration of naps. Late naps, such as those in the “forbidden zone” from 7-9 PM are more likely to have impacts on subsequent sleep, while naps taken in the afternoon might produce greater benefits (Lastella et al. 2021; Milner & Cote, 2009). As naps can impact how long it takes to fall asleep that night (Petit et al., 2018), it is important to consider the duration of the nap, and athletes who suffer symptoms of insomnia may not have the same benefits from napping if it exacerbates their insomnia. Generally, naps of less than 30 min are less likely to be associated with sleep inertia, or grogginess experienced after awakening (Milner & Cote, 2009). Overall, naps should be limited to between 20-90 min to maximize the benefits but reduce negative impacts of the nap on sleep that night (Lastella et al., 2021). It is also important to allow at least 30 min for athletes to recover from sleep inertia if they take a longer nap (Lastella et al., 2021). To help with falling asleep for a nap, athletes should apply rules of sleep hygiene to prepare themselves for sleep.

BANK SLEEP FOR BETTER PERFORMANCE

The term “banking” sleep means to get extra sleep in advance of an important event or sleep deprivation period to have sleep “in the bank” to help improve performance. In the general population, getting more sleep than usual leading into a sleep deprivation period was shown to improve reaction time versus the participants that got a normal amount of sleep but did not perform as well (Rupp et al., 2009). This research has been replicated in athletes from various sports and disciplines. In military tactical athletes after four sleep extension nights, there were improvements in reaction time, standing jump distance, and motivation (Ritland et al., 2019). In tennis athletes after one week of

nine hours of sleep a day, there was increased serving accuracy by 6% (Schwartz & Simon, 2015). In endurance cyclists after 3 days of 1.5 h extra sleep per night, there was a 3% improvement in time trial performance (Roberts et al., 2019). By understanding this strategy, it can help athletes prioritize sleep and also ease anxiety when an athlete is concerned about pre-competition sleep.

GOOD SLEEP BEHAVIOR PRACTICES (PREPARING THE MIND, BODY, AND ENVIRONMENT FOR SLEEP)

REDUCE EVENING LIGHT EXPOSURE

Exposure to evening light can delay the onset of melatonin secretion (Knufinke et al., 2019), particularly if bright or blue light. This exposure can increase evening alertness (van der Lely et al., 2015) and ultimately sleep latency (Knufinke et al., 2019). When evening light is unavoidable, athletes can use blue-light-blocking amber glasses to reduce the impact on their nighttime sleep. These glasses have been shown to prevent the suppression of melatonin and have benefits for subsequent sleep quality (Van der Lely et al., 2015). There is also an option to download applications on phones that will reduce the blue light emitted in the evening hours (Chiu & Liu, 2020; Gringras et al., 2015). Getting natural light earlier in the day can also help reduce the impact of evening light on subsequent melatonin secretion and sleep (Hébert et al., 2002).

PRE-SLEEP ROUTINE

It is important to implement a bedtime routine that promotes relaxation and prepares the athlete mentally in the last hour before sleep. For instance, engagement with smartphones affects sleep not only due to the light emitted but also due to stimulating content from social media (Tandon et al., 2020; Van der Schuur et al., 2019). Using electronic devices just before bed coupled with difficulty falling asleep is often reported in athletes (Jones et al., 2019). To wind down before bed, it is better to read a paper book (Finucaine et al., 2021). To help with racing thoughts before bed, to-do lists (Scullin et al., 2018) and the cognitive shuffle (Beaudoin, 2014) can assist with preparation for sleep. An example of the cognitive shuffle includes thinking of a word, and all the objects one can think of that start with each letter of that word. These activities can assist with the mental preparation for sleep by reducing worry and providing cognitively engaging activities to occupy the mind.

To physically prepare for sleep, a warm bath or shower before bed can help decrease body temperature as blood flow increases in the extremities (Haghighayegh, et al., 2019). A reduction in body temperature can improve the quality, efficiency, and latency of subsequent sleep. Temperature decreases are also a natural signal to the body that it is time for sleep and cooling off after a bath can mimic this effect (Yetish et al., 2015). Stretching and deep breathing are also good ways to prepare the body physically for a good night of sleep (D'Aurea et al.,

2014, Jerath et al., 2019). Deep breathing can also promote relaxation and reduce feelings of anxiety (Pandekar & Thangavelu, 2019).

SLEEP ENVIRONMENT

Our ancestors evolved to sleep in cave environments, and to best promote sleep, keeping the environment as cool, dark, and quiet as possible is beneficial. As already mentioned, temperature is a key cue that it is time to sleep. For both individuals with sleep apnea and those with insomnia symptoms, temperatures between 16 and 20°C have benefits for sleep duration, efficiency, and sleeping pill usage (Min et al., 2021; Valham et al., 2012). Also as previously mentioned, minimal exposure to bright light is best for sleep and melatonin secretion. The lights in half of homes are bright enough to impact melatonin release (Cain et al., 2020), and many neighbourhoods also have high amounts of artificial light which can lead to shortened and poor sleep (Gabinet & Portnov, 2021). If external light is coming in the window, blackout curtains may be effective. Even within the bedroom, low light exposure from uncovered light sources, such as a lamp, can reduce slow waves during sleep, and increase arousal (Cho et al., 2013). Covering light sources and turning off lights in the room can help reduce this risk. Finally, minimizing noise in the environment is important for a good night of sleep. Areas with high amounts of environmental noise can lead to late bedtimes and poor sleep quality (Rudolph et al., 2019). Ear plugs or white noise are simple and effective ways to reduce external noise and lead to better subjective sleep quality, lower wake time during the night, and shorter sleep latency (Jones & Dawson, 2012; Ebben et al., 2021).

STRATEGIC USE OF CAFFEINE AND SUPPLEMENTS

As an ingredient of many pre-workout supplements, caffeine is often consumed by athletes (Miller et al., 2014). Caffeine can lead to performance benefits, but it can also affect sleep by increasing sleep latency and reducing sleep efficiency and duration (Miller et al., 2014). After an adrenaline and caffeine-fueled game, 20% of rugby players reported pulling an all-nighter (Dunican et al., 2018). A night with no sleep will only reduce performance the following days and highlights a downside to caffeine intake for athletes. Performance benefits due to caffeine could at times be countered by performance deficits due to poor sleep. However, there are other easily accessible supplements that have shown benefits for sleep. Tart cherry juice can impact melatonin secretion, increase sleep efficiency, and total sleep time (Howatson et al., 2012; Losso et al., 2018). For best effects, it can be taken twice daily, in the morning and evening. Additionally, magnesium can also be taken to benefit symptoms of insomnia, particularly in those who have a deficiency in magnesium, although this work was done with older adults (Abassi et al., 2012; Mah & Pitre, 2021).

PRACTICAL APPLICATIONS & SUMMARY

Athletes seem to be more at risk for sleep disturbances and are uniquely impacted by poor sleep. Fortunately, there are strategies that can be implemented to improve sleep in athletes. In this SSE article we focused on 5 different strategies (Figure 1):

1. **Frequently educate athletes about the importance of sleep:** It is important for athletes to get good sleep education information because of the prevalent myths that exist. Understanding the true basics of sleep such as quantity, quality, timing, and ways to prepare for sleep are key. One sleep education session may not be enough, as research has shown beneficial changes in sleep after one sleep session, but the effect was not maintained long-term. Frequent check-ins with your athletes on sleep and reinforcing how good sleep benefits performance should help facilitate positive sleep behaviour change that can be maintained.
2. **Screen athletes for significant sleep problems:** Prior research has found that clinically relevant sleep disturbances can occur in ~25% of athletes. This means that if you are not sleep screening your athletes there may be little progress with a significant group of athletes. It is important to use questionnaires validated in athletes (e.g., Athlete Sleep Screening Questionnaire) to accurately identify the athletes that need help. Since interventions for sleep disorders may require further sleep testing and treatment, the sleep screening should take place during a time that is least disruptive to the athlete such as during the pre- and post-season.
3. **Encourage napping in athletes by providing opportunities:** Napping can help athletes recover from poor sleep and provide gameday benefits. Naps between 20 and 90 min taken in the afternoon are beneficial but minimize negative impacts on sleep that night. Naps greater than 30 min may also cause sleep inertia and make the athlete groggy, and at least 30 min may be needed to recover.
4. **Bank sleep for better performance:** Getting more sleep than usual has been shown to improve reaction time, sprint times, and even sport-specific skills. Aside from these performance benefits, it can also reduce anxiety the night before a competition if an athlete doesn't sleep as well as normal because they have sleep in the "bank". It doesn't have to be for multiple weeks or months in advance either. The amount of time banked has varied in the literature, with some studies showing benefits of weeks versus other studies showing benefits from just one day.

5. Prepare for sleep: The environment, the mind, and the body

- Reduce evening light exposure: Exposure to bright light can suppress melatonin secretion and make it more difficult to fall asleep. To avoid the impact of bright light on sleep, athletes can wear blue-light-blocking amber glasses, and use light-reducing smartphone applications. Getting more light earlier in the day can also counter bright light in the evening.
- Implement a good pre-sleep routine about an hour before bedtime: To help prepare the mind for sleep, put away electronic devices and pick up a paper book. To help fall asleep, try writing a to-do list and implementing the cognitive shuffle. To prepare the body for sleep and improve sleep quality, try stretching and a warm bath or shower.
- Keep the sleep environment cave-like: To keep the bedroom like a cave, reduce bedroom and window sources of light by turning off or covering light sources and using blackout curtains. Reduce noise, wear ear plugs, or listen to white noise to make the bedroom as quiet as possible. Finally, keep the bedroom cool, ideally between 16 and 20°C.
- Be strategic about using caffeine and supplements: While caffeine can offer some performance benefits, its impact on sleep might counteract some of those benefits. It is important to be strategic about the use of caffeine and timing in relation to sleep to reap the maximum benefits. Alternative supplements to improve sleep quality include tart cherry juice and possibly magnesium.

We have highlighted these important tips to keep in mind when working with athletes and their sleep. This is not an exhaustive list and the following are additional resources (Byrne & Byrne, 2020; Creado, 2020; Lastella et al., 2021; Walsh et al., 2020; <https://centreforsleep.com/education-and-awareness/athlete-sleep-screening-questionnaire/>). Taken together, these strategies can help athletes become well-rested and ready to play.



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ATHLETES ABOUT THE
IMPORTANCE OF SLEEP**



**SCREEN ATHLETES FOR
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**ENCOURAGE NAPPING IN
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**PREPARE FOR SLEEP: THE
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Figure 1. Top Five Practical Recommendations to Improve Sleep in Athletes

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