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Monitoring and Improving Sleep Quality in Professional Athletes

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Abstract

Introduction and Purpose:

Sleep is a fundamental component of performance, recovery, and overall health in professional athletes. However, sleep disturbances—including insufficient duration, poor quality, and insomnia—are highly prevalent in this population due to factors such as early-morning training, late-evening competitions, transmeridian travel, and psychological stress. This review aims to provide a comprehensive summary of current knowledge regarding sleep monitoring techniques and evidence-based interventions to improve sleep in elite athletes.

Methods:

We conducted a structured literature search in PubMed, Embase, and UpToDate through May 2025. Eligible studies included systematic reviews, randomized controlled trials, observational studies, and consensus guidelines focusing on sleep in professional, elite, or Olympic-level athletes. Search terms included combinations of "sleep," "athletes," "interventions," and "performance." Findings were narratively synthesized under thematic headings.

Current State of Knowledge:

Up to 60% of elite athletes report poor sleep quality, and 27–37% exhibit insomnia symptoms during competition periods. Key contributors include circadian disruption, high training loads, pre-competition anxiety, and environmental/lifestyle factors. Assessment tools such as actigraphy and the Athlete Sleep Screening Questionnaire (ASSQ) are validated and widely used. Non-pharmacological strategies, especially sleep hygiene education, sleep extension, strategic napping, CBT-I, and light exposure demonstrate positive effects on sleep duration, quality, and performance. Melatonin shows potential for managing jet lag, though evidence in athletic settings remains limited. Sedatives are rarely studied and should be used with caution.

Conclusions:

Sleep problems are common and impactful in elite sport. Personalized, non-pharmacological approaches should be prioritized, while further research is needed to refine and validate targeted interventions.

Keywords: sleep disorders; sports, athletes; melatonin; chronobiology disorders

Introduction

Sleep is a critical factor in athletic performance, recovery, and overall health. In professional athletes, adequate sleep supports the ability to train effectively, prevent injuries, and maintain mental well-being [1]. Over the past decade, there has been growing recognition across virtually every sport of the importance of sleep for optimizing performance [2]. At the same time, elite athletes are particularly susceptible to sleep inadequacies – they often get less than 7 hours of sleep and experience poor sleep quality due to the demands of their sport. Poor sleep in athletes is linked to impaired cognitive and physical performance, slower recovery from training, and even increased injury risk [3]. This has led to heightened interest in monitoring athletes' sleep and implementing interventions to improve sleep quality.

Despite the widespread agreement that "sleep is an advanced recovery tool," many professional athletes continue to experience insufficient or disturbed sleep [1,4]. A variety of sport-specific and environmental challenges – from grueling travel schedules to pre-competition anxiety – can degrade sleep in this population [3]. To address these issues, sports medicine practitioners and scientists have been developing evidence-based strategies for assessing and managing sleep among elite competitors. This review provides a comprehensive overview of current practices for monitoring and improving sleep quality in professional athletes. We summarize the current state of knowledge from recent peer-reviewed literature (with an emphasis on the last 5 years) and compare it with earlier findings to highlight evolving trends.

Methods

We conducted a literature search of PubMed, UpToDate and Embase for peer-reviewed articles related to sleep in professional and elite athletes (including systematic reviews, meta-analyses, randomized controlled trials, observational studies, and consensus guidelines). Key search terms included combinations of "sleep," "athletes," "professional athletes," "elite athletes," "sleep quality," "sleep interventions," and "performance."

Current State of Knowledge

Prevalence of Sleep Disturbances in Professional Athletes

Research consistently shows that a large proportion of athletes do not obtain optimal sleep duration or quality on a regular basis. Self-report studies of elite and professional athletes indicate average nightly sleep durations around 7–8 hours, yet a substantial subset sleeps well

below these recommendations. For example, in one cross-sectional study of 313 adult athletes across sports, about 19% slept less than 7 hours per night and 50% slept less than 8 hours, despite an average self-reported sleep duration of ~7.5 hours. Furthermore, over half of the athletes (55%) were classified as having poor sleep quality based on a Pittsburgh Sleep Quality Index (PSQI) global score ≥5 [5]. Similarly, other surveys have found that 40–60% of athletes report "poor" sleep by standard criteria [6]. These rates of disturbed sleep are markedly higher than those observed in age-matched general populations, underscoring that sleep problems are extremely common among athletes [1].

Insomnia symptoms in particular are frequently reported. Evidence suggest that roughly 27% to 37% of active athletes experience significant insomnia symptoms (difficulty falling or staying asleep) during their competitive seasons [7-9]. One review noted that insomnia (difficulty initiating sleep) is reported by about one-third of elite athletes, and up to 77% have experienced middle-of-the-night awakenings or sleep maintenance insomnia in some surveys [10]. Notably, the night surrounding important competitions are a flashpoint for sleep disturbance. Performance anxiety and pre-competition arousal often lead to acute insomnia before events. More than 60% of athletes report worse-than-usual sleep (often frank insomnia) on at least one occasion the night before a major competition [11]. In a large survey of over 600 elite athletes, approximately 64–66% reported that their sleep was disturbed prior to important competitions (e.g. difficulty falling asleep due to nerves) [12]. Such acute sleep loss around competition is almost considered normal in elite sport, though it may still impair next-day performance. Beyond competition anxiety, high training loads and congested competition schedules can also degrade sleep. Paradoxically, athletes often sleep less during periods of intensified training – precisely when recovery needs are greatest [13]. For instance, a study of Olympic-level swimmers showed they averaged only ~5.4 hours of sleep on nights before early-morning training sessions, compared to ~7.1 hours on rest days [14]. Similarly, professional soccer players obtained significantly less sleep following evening matches: on average 157 minutes less sleep after a night game than after a daytime match, and ~180 minutes less than after a light training day [15]. These examples illustrate how scheduling demands can curtail athletes sleep duration.

It is important to note that athletes themselves recognize the importance of sleep, even if they struggle to get enough. In a survey of nearly 900 high-level athletes (spanning sexes, sports, and competition levels), sleep was ranked as the single most important recovery strategy – above other modalities like nutrition or physical therapies [16]. Yet many athletes fail to consistently achieve the recommended 7–9 hours of nightly sleep for adults. In fact, one

recent analysis reported that 71% of elite athletes do not get the amount of sleep they feel they need (on average, athletes estimated they needed ~8.3 hours to feel rested) [17]. Taken together, current data indicate that insufficient sleep and poor sleep quality are widespread issues in professional sports. These sleep deficits are not merely inconveniences; they have tangible consequences for performance and health, as discussed later. The high prevalence of disturbed sleep in athletes has driven efforts to identify contributing factors and to develop targeted interventions to improve sleep in this unique population.

Factors and Challenges Affecting Athlete Sleep

Professional athletes face numerous unique challenges that can adversely impact their sleep. These factors can be broadly grouped into sport-specific factors (related to training, travel, and competition schedules) and individual or environmental factors (such as anxiety, stress, and other personal attributes) [18-19]. Understanding these challenges is key to developing effective sleep management strategies for athletes.

Training and Competition Schedules

The timing of training sessions and competitions is a major determinant of athletes' sleep patterns. Early morning training sessions (common in sports like swimming, rowing, or track) require athletes to wake up very early, often resulting in curtailed sleep on those nights. Repeated early sessions can lead to a chronic sleep deficit. Evening competitions or games pose the opposite problem – athletes may be physically and mentally aroused after late games, making it difficult to wind down and fall asleep at a normal hour. As noted, elite football (soccer) players slept over 2.5 hours less on nights after late-evening matches compared to after daytime matches. Travel back from away games at night further delays bedtime [20]. High training loads can also interfere with sleep. Heavy exercise close to bedtime may elevate cortisol and core temperature, delaying sleep onset, while muscle soreness or injuries can disrupt sleep continuity. Sleep disturbances in athletes are often attributed to chronic pain stemming from previous injuries [21-22].

Travel and Jet Lag

Professional athletes, especially those in international competitions or leagues spanning large geographic areas, frequently travel across time zones. Travel across multiple time zones leads to circadian misalignment (jet lag), which is characterized by sleep disruption, fatigue, and other symptoms [23]. Jet lag occurs because the body's internal clock is out of sync with the new local time; a rule of thumb is that re-aligning circadian rhythms takes roughly 1–1.5 days per time zone crossed [24].

Psychological Factors

Performance anxiety is particularly acute around important competitions and is a well-documented trigger of insomnia in athletes. Over 60% of athletes report pre-competition insomnia as noted above, often attributed to anxiety, "racing thoughts," or *overthinking* the upcoming performance [25]. Depression affects approximately 4.4% of the global population, while anxiety disorders affect 3.6%, according to the World Health Organization [27]. However, evidence suggests that athletes may be at greater risk for these mental health conditions. In a large survey of Australian elite athletes, the prevalence of depressive symptoms was 27.2%, with eating disorders affecting 22.8%, social anxiety 14.7%, and generalized anxiety disorder 7.1% [28]. These rates markedly exceed those reported in the general Australian population, where the prevalence of depression and anxiety has been estimated at 10.4% and 13.1%, respectively [29]. In some athlete subgroups, the combined prevalence of depression and anxiety symptoms has been reported to reach as high as 47.8% [30].

Environmental and Lifestyle Factors

During competitions, they may contend with noisy hotels, roommate disturbances, or irregular meal times – all of which can impair sleep. Additionally, electronic device use in the evenings is common in young athletes. Excessive screen time at night exposes athletes to blue light and mental stimulation that can delay melatonin release and sleep onset [31]. Caffeine use is another relevant lifestyle factor. Athletes often consume caffeine to enhance performance, but if taken later in the day, caffeine can significantly worsen that night's sleep latency and efficiency [32]. By way of illustration, evening (≥5 p.m.) caffeine intakes >2 mg·kg−1 body mass decreases sleep duration and sleep efficiency as well as increased sleep latency [33].

Sleep Monitoring Techniques in Athletes

Accurately assessing sleep is the first step in addressing sleep problems in athletes. In clinical sleep medicine, polysomnography (PSG) – an overnight laboratory recording of brain waves, eye movements, muscle activity, heart rhythm, breathing, and blood oxygen – is considered the *gold standard* for sleep measurement [34]. PSG provides detailed information on sleep architecture, continuity, and disorders such as sleep apnea. However, PSG is impractical for routine monitoring of athletes, especially in their home or travel environments, and for tracking sleep across multiple nights or multiple athletes simultaneously [35]. While PSG is used to clinically diagnose specific sleep disorders in athletes when needed, it is not used for day-to-day monitoring in most sports settings [36-37].

In practice, sports teams and researchers rely on a combination of wearable devices and self report instruments to monitor athletes' sleep. Actigraphy is one of the most common objective methods. It involves a wrist-worn device (actigraph or activity monitor) that uses accelerometer data to estimate sleep and wake times. Actigraphy has been widely validated against PSG in both general and athletic populations. Studies show that wrist activity monitors have roughly 85–90% agreement with PSG in distinguishing sleep vs. wake when appropriate algorithms are used [38]. These devices are quite sensitive to sleep (typically detecting over 80% of actual sleep epochs) but less specific in detecting wakefulness, meaning they may mis-score quiet wake time as "sleep" on occasion [39]. Actigraphy tends to underestimate total sleep time by 18–90 minutes and correspondingly overestimate wake time during the night, depending on the scoring threshold applied [35]. Despite these limitations, actigraphic monitoring is very useful for capturing habitual sleep patterns over weeks of training and competition. It allows tracking of bedtime, wake time, total sleep hours, and sleep efficiency (percent of time in bed spent asleep) in the athlete's natural environment [40].

Sleep diaries and questionnaires

Standardized questionnaires gauge an athlete's typical sleep quality and daytime sleepiness. The Pittsburgh Sleep Quality Index (PSQI) is frequently used in studies to quantify overall sleep quality. The PSQI was used to show that 55% of athletes rated as poor sleepers in the study conducted by Randell et al. [5,41]. Another common instrument is the Epworth Sleepiness Scale (ESS), which measures general daytime sleepiness. In a collegiate athlete survey, over half had an ESS score indicating excessive daytime sleepiness, aligning with their high rate of poor sleep quality [42]. While PSQI and ESS were developed for general populations, athletes often score differently (young athletes might underreport sleepiness due to high motivation). To address this problem, researchers have developed athlete-specific questionnaires. One such tool is the Athlete Sleep Screening Questionnaire (ASSQ), which was designed to flag athletes who may have clinically significant sleep issues requiring follow-up. The ASSQ asks about sleep duration, quality, insomnia symptoms, chronotype, and other factors in an athlete-friendly manner [43-45]. Clinical validation of the ASSQ has shown it to be effective in aforementioned study conducted by Bender et al. About 25% of elite athletes screened positive for a probable sleep problem, and the ASSQ correctly identified those in need of further assessment with high sensitivity and specificity (81% and 93%, respectively, against a physician's evaluation) [5].

Sleep Hygiene and Education

Basic sleep hygiene education remains a foundational component. It includes

recommendations such as maintaining a regular sleep-wake cycle, creating a dark and quiet sleep environment, and limiting caffeine and electronic use before bedtime. A study by O'Donnell et al. demonstrated that a one-hour sleep education session significantly improved sleep duration and reduced wake time variability in elite female athletes [46].

Sleep Extension

Chronic sleep restriction is common in elite sport. Extending total sleep opportunity—by increasing time in bed—has shown marked performance and mood benefits. Mah et al. reported that collegiate basketball players who increased their sleep duration to approximately 10 hours per night exhibited faster sprint times, improved shooting accuracy, and enhanced mood [47].

Napping

Strategic daytime napping is an effective method to supplement insufficient nocturnal sleep. A systematic review found that naps improved both physical and cognitive performance in athletes and were well tolerated [48].

Relaxation and Cognitive Techniques

Techniques such as mindfulness meditation, progressive muscle relaxation, and guided imagery have been shown to reduce pre-sleep arousal and improve sleep onset latency. Furthermore, cognitive behavioral therapy for insomnia (CBT-I) has demonstrated effectiveness in athletic populations, with improvements in sleep quality and post-concussive symptom reduction [49,50]. CBT-I is the gold-standard treatment for chronic insomnia in the general population and is increasingly applied to athletes. It combines cognitive restructuring, sleep scheduling, and relaxation techniques. A recent trial confirmed that CBT-I increased sleep time by approximately 30 minutes, both subjectively and via polysomnography [50].

Light Exposure and Circadian Regulation

Proper management of light exposure plays a key role in aligning circadian rhythms. Exposure to bright light in the morning can advance the sleep phase, while reducing blue light exposure at night promotes melatonin release. In professional team-sport athletes, greater daytime light exposure was associated with improved objective and subjective sleep metrics [51].

Melatonin

It is a hormone that regulates circadian rhythm and is available over-the-counter in many countries as a sleep aid. Exogenous melatonin is particularly useful for shifting the timing of sleep (chronobiotic effect) and is commonly used to combat jet lag or reset a disturbed sleep schedule [52]. A Cochrane meta-analysis has confirmed that melatonin is effective in

preventing and reducing jet lag when traveling across multiple time zones, with short-term use being safe and resulting in improved sleep and reduced jet-lag symptoms in travelers [53]. However, it's worth noting that sports-specific evidence on melatonin's efficacy is limited. A 2021 review on managing jet lag in athletes found surprisingly little direct research on melatonin in elite athletic populations [54]. Two controlled studies were identified, One suggested it may speed up circadian resynchronization after long-haul travel, while the other showed mixed results. Both lacked control groups and had small samples, and one combined melatonin with other interventions. Thus, although melatonin may help with jet lag, larger controlled studies are needed to confirm its effectiveness [55-56].

Sedatives

Only a single non-randomized study has investigated the use of sedatives, specifically temazepam, in athletes following actual long-distance travel. However, the intervention group was heterogeneous, comprising both athletes and support personnel, which limits the ability to draw athlete-specific conclusions. Furthermore, there are currently no studies focusing on the use of short-acting hypnotics, such as zolpidem or zopiclone, in athletic populations [57].

Conclusions

Sleep is a critical factor for performance, recovery, and mental health in professional athletes. Yet, sleep disturbances including insufficient duration and poor quality are widespread due to early training, late competitions, frequent travel, and psychological stress.

Wearable devices like actigraphy and tools such as the Athlete Sleep Screening Questionnaire (ASSQ) allow for practical sleep monitoring and early identification of problems. Among non-pharmacological strategies, sleep hygiene education, extending sleep duration, and napping show strong evidence of benefit. Relaxation techniques and cognitive behavioral therapy for insomnia (CBT-I) also improve sleep quality, especially in athletes with anxiety or chronic sleep issues. Light exposure management and melatonin may support circadian adjustment, although evidence in elite athletes is limited.

Pharmacological interventions are rarely studied and should be used cautiously due to potential risks and anti-doping concerns. Overall, individualized, non-drug approaches should be prioritized, with sleep integrated into athlete care programs. More high-quality studies in elite populations are needed to optimize sleep strategies.

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Author's contribution:
Conceptualization: Julia Ząber
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Writing – rough preparation: Patryk Dąbrowski
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