

The Relationship Between Sleep Quality and Sports Performance: An Analytical Study of the Factors for Achieving Sports Excellence

علاقة جودة النوم بالأداء الرياضي: دراسة تحليلية لعوامل بلوغ التفوق الرياضي

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Abstract : This study aims to explore the multidimensional relationship between sleep quality and sports performance by analyzing the physiological, neurological, and psychological factors that explain the impact of sleep on physical and skill - based abilities, relying on a systematic analysis and critical review methodology and drawing upon the latest evidence derived from meta - analyses and randomized controlled trials. The study found that sleep deprivation negatively affects various components of sports performance, with a notable increase in the rate of perceived exertion. The results also showed that partial sleep deprivation in the early part of the night affects anaerobic and explosive capacities, while deprivation in the latter part affects motor control. The study concludes that improving sleep quality through sleep hygiene strategies and sleep extension constitutes an effective approach to enhancing sports performance and reducing injury risks.

Keywords: sleep quality, sports performance, sports excellence.

المخلص : تهدف هذه الدراسة إلى استكشاف العلاقة متعددة الأبعاد بين جودة النوم والأداء الرياضي وذلك من خلال تحليل العوامل الفسيولوجية والعصبية والنفسية التي تفسر تأثير النوم على القدرات البدنية والمهارية، وذلك بالاعتماد على منهجية التحليل المنهجي والمراجعة النقدية مستعينة بأحدث الدلائل المستمدة من الدراسات التلوية والتجارب المعشاة. وقد توصلت الدراسة إلى أن الحرمان من النوم يؤثر سلبا في مختلف مكونات الأداء الرياضي، مع زيادة ملحوظة في معدل الجهد المدرك، كما أظهرت النتائج أن الحرمان الجزئي من النوم في الجزء المبكر من الليل يؤثر في القدرات اللاهوائية والانفجارية، بينما يؤثر الحرمان في الجزء المتأخر في التحكم المهاري، وتخلص الدراسة إلى أن تحسين جودة النوم عبر استراتيجيات النظافة الصحية وتمديد النوم يعد مدخلا فعالا لتعزيز الأداء الرياضي وتقليل مخاطر الإصابات.

- الكلمات المفتاحية : جودة النوم، الأداء الرياضي، التفوق الرياضي.

*** Introduction**

Modern sports performance is witnessing rapid development amid intense competition at global excellence levels, where achieving sports achievement is no longer solely linked to training quality or innate physical abilities but rather requires a comprehensive approach that encompasses various factors influencing athlete efficiency. In this context, sleep has emerged as a critical factor mediating the relationship between training and recovery, directly affecting the athlete's ability to deliver optimal performance. Sleep has become a central focus in sports medicine and performance science research due to its vital role in physiological recovery processes, motor memory consolidation, hormonal regulation, and psychological stability (Charles SAMUELS, 2008, p 172; Michael GRANDNER, ATHEY, 2024, p 45).

Scientific literature has shown that athletes often suffer from sleep deficiency and poor quality, with studies indicating that the average sleep duration among Olympic athletes does not exceed 6 hours and 10 minutes, a duration significantly lower than the actual needs reaching 8.3 hours (Michele LASTELLA and others, 2015, p 96; Spencer ROBERTS and others, 2019, p 1382). A recent study on American university athletes showed that the average sleep duration was 409.2 minutes (approximately 6.8 hours) with an actual need reaching 7 hours and 58 minutes to maintain quality of life related to physical and psychological health (Jason GOLDMAN and others, 2024, p 373). This sleep deficit raises fundamental questions about its effects on sports performance, the mechanisms of these effects, and strategies for improving sleep as an entry point to achieving sports excellence.

This study stems from the hypothesis that sleep quality is not merely an auxiliary factor in sports performance but a primary determining factor through

which qualitative gains can be achieved in various components of physical, skill-based, and psychological performance. Accordingly, the study aims to provide an in-depth scientific analysis of the relationship between sleep quality and sports performance by answering the following questions: What are the physiological and neurological mechanisms that explain the impact of sleep on sports performance? How does sleep deprivation affect the various components of physical and skill-based performance? What are the evidence-based strategies for improving sleep quality among athletes?

1. Study Methodology

This study adopted an analytical approach based on critical review and systematic analysis of scientific literature, following these steps:

1.1. Systematic Search: Searches were conducted in major scientific databases (PubMed, Web of Science, Scopus, Cochrane Library, EBSCO) for studies published during the period 2010–2025, using a set of keywords: “sleep quality,” “sleep deprivation,” “sports performance,” “sports performance,” “recovery,” “elite athletes,” “circadian rhythms,” “sleep hygiene,” “sleep extension.”

1.2. Selection Criteria: Included randomized controlled trials, cross-sectional studies, longitudinal studies, systematic reviews, and meta-analyses that addressed the relationship between sleep and sports performance among athletes of various levels and age groups.

1.3. Data Analysis: Quantitative and qualitative data were extracted from selected studies, focusing on effect size in meta-analyses and analyzing physiological and psychological correlation mechanisms.

2. Foundations of Sleep Biology and Its Relationship to Sports Performance

2.1. Sleep Structure and Its Physiological Regulation

Sleep represents a complex biological process involving integrated neural, hormonal, and biochemical interactions, consisting of recurring cycles of Non-Rapid Eye Movement (NREM) sleep and Rapid Eye Movement (REM) sleep, each cycle lasting approximately 90 minutes (Marta RUTKOWSKA and others, 2024).

Slow Wave Sleep, or deep sleep, plays a pivotal role in physical recovery processes, during which growth hormone secretion, essential for repairing muscle tissue and rebuilding proteins damaged by physical exertion, increases (Mounir CHENNAOUI and others, 2015, p 65). In contrast, REM sleep contributes to motor memory consolidation and skill learning, explaining the importance of adequate sleep in improving motor learning and acquiring sports skills (Matthew WALKER, 2009, p 180).

The sleep-wake cycle is subject to dual regulation: homeostatic regulation, which controls the increasing sleep pressure with prolonged wakefulness, and circadian regulation, which controls sleep and wake timing according to a 24-hour cycle (Alexander BORBÉLY and others, 2016, p 132).

The circadian rhythm is a critical factor in the timing of sports performance peaks, as the best levels of physical performance (speed, strength, endurance) coincide with the peak of core body temperature occurring in the late evening hours (Jacopo VITALE, WEYDAHL, 2017, p 1765).

2.2. Physiological and Neurological Mechanisms of Sleep's Impact on Sports Performance

The mechanisms explaining sleep's impact on sports performance are numerous and can be classified according to the following levels:

a. Central Neurological Mechanisms: Sleep deprivation affects central nervous system functions by increasing adenosine accumulation in the brain, an inhibitory neurotransmitter that suppresses neural activity and impairs alertness and attention (Tarja PORKKA - HEISKANEN and others, 2013, p 220). Sleep deprivation also leads to decreased activity in the prefrontal cortex responsible for executive functions and motor planning, affecting the athlete's ability to make quick and accurate decisions during competition (Yvonne HARRISON, HORNE, 2000, p 242).

b. Hormonal Mechanisms: Sleep plays a crucial role in regulating hormonal secretion, as growth hormone and prolactin secretion increase during deep sleep; both are essential for recovery and muscle rebuilding processes (Eve VAN CAUTER and others, 2008, p 25). Sleep deprivation also leads to elevated cortisol levels (stress hormone) with decreased testosterone levels, negatively affecting the muscles' ability to produce power and recovery processes (Rachel LEPROULT and others, 1997, p 868).

c. Metabolic Mechanisms: Sleep deprivation affects glucose metabolism and muscle glycogen stores, impairing the athlete's ability to endure prolonged exertion and increasing reliance on anaerobic energy sources, Sleep deprivation also leads to dysregulation of appetite, increasing ghrelin (hunger) and decreasing leptin (satiety), which may affect the athlete's weight and body composition (Karine SPIEGEL and others, 2004, p 848).

d. Inflammatory Mechanisms: Studies have shown that sleep deprivation increases levels of inflammatory markers (such as IL-6 and TNF- α), prolonging recovery time after exercise and increasing injury risk (Michael IRWIN, 2015, p 160; Norah SIMPSON, DINGES, 2007, p 248).

3. The Impact of Sleep Quality on Components of Sports Performance

3.1. Meta-Analytic Evidence on the Effects of Sleep Deprivation

Numerous systematic reviews and meta-analyses have been conducted to examine the impact of sleep deprivation on sports performance, with consistent results showing clear negative effects. In the most recent and comprehensive meta-analysis, (Yuxiang KONG and others, 2025) conducted a study encompassing 45 studies investigating the effect of sleep deprivation on various types of sports performance, involving both athletes and non-athletes. Results showed that sleep deprivation negatively affects aerobic endurance in athletes with a moderate effect size (SMD = -0.66 ; 95% CI: -1.28 to -0.04 ; $P = 0.04$), meaning that sleep-deprived athletes suffer a notable decline in their ability to sustain continuous aerobic performance (Yuxiang KONG and others, 2025, p 8).

The analysis also showed that sleep deprivation affects explosive strength (SMD = -0.63 ; $P < 0.00001$), maximal strength (SMD = -0.35 ; $P = 0.001$), speed (SMD = -0.52 ; $P = 0.0008$), and motor control (SMD = -0.87 ; $P = 0.04$). Sleep deprivation was also associated with an increase in the rate of perceived exertion (RPE), with an effect size of SMD = 0.39 ; $P = 0.006$, meaning that sleep-deprived athletes feel greater effort while performing the same physical tasks compared to their normal state (Yuxiang KONG and others, 2025, p 9).

Table 1. Effect sizes of sleep deprivation on sports performance components

Performance Component	Effect Size (SMD)	95% CI	Significance
Aerobic Endurance	−0.66	−1.28, −0.04	P = 0.04
Explosive Strength	−0.63	−0.85, −0.41	P < 0.00001
Speed	−0.52	−0.71, −0.33	P = 0.0008
Motor Control	−0.87	−1.71, −0.03	P = 0.04
Rate of Perceived Exertion	0.39	0.11, 0.67	P = 0.006

Source: Yuxiang KONG and others, 2025, p 8

3.2. Impact of Sleep Deprivation on Aerobic and Anaerobic Endurance

Aerobic endurance is among the performance components most affected by sleep deprivation due to its reliance on the integration of cardiovascular, respiratory, and aerobic metabolic functions. A study by (Jamie CRAVEN and others, 2022, pp 2669–2690) showed that sleep deprivation leads to a 10– 15% reduction in time to exhaustion during aerobic endurance tests, associated with increased heart rate and decreased ability to maintain maximal oxygen consumption. Results from the meta– analysis conducted by (Thiago LOPES and others 2023, pp 721-733) also showed that sleep deprivation affects aerobic performance regardless of the athlete’s training level, although the effect was more pronounced in non– athletes (SMD = −1.02) compared to athletes (SMD = −0.66) (Yuxiang KONG and others, 2025, p 9).

Regarding anaerobic performance, studies have shown that sleep deprivation affects the ability to repeat maximal and explosive efforts. (Nizar SOUISSI and others, 2013, pp 2473-2480) found that 24 hours of sleep deprivation led to an 8–12% decrease in performance during the repeated sprint test (Wingate test). (Bing GONG and others, 2024, pp 245–258) also showed that partial sleep deprivation in the early part of the night (PSDE) particularly affects anaerobic and explosive performance ($SMD = -1.04$), reflecting the importance of early sleep, which contains the highest proportion of slow-wave sleep responsible for physical recovery.

3.3. Impact of Sleep Deprivation on Muscular Strength and Speed

Muscular strength and speed capabilities are significantly affected by sleep deprivation due to these capabilities' dependence on neuromuscular efficiency and concentrations of adenosine triphosphate and muscle glycogen. Results from the meta-analysis showed that sleep deprivation affects maximal strength with a moderate effect size ($SMD = -0.35$) and speed with a clear effect size ($SMD = -0.52$) (Yuxiang KONG and others, 2025, p 8). A study by (François BLACHIER and others, 2021) showed that 24 hours of sleep deprivation led to a 5–8% decrease in grip strength and knee extensor muscle strength, with core (trunk) strength not affected to the same degree.

In a related context, (Melissa SKEIN and others, 2011) showed that 30 hours of sleep deprivation led to a 3.5% decrease in 20-meter sprint time, with a decrease in the ability to repeat maximal speeds in repeated tests.

3.4. Impact of Sleep on Motor Control and Cognitive Functions

Motor control is among the performance components most sensitive to sleep quality due to its reliance on the integration of sensory, motor, and

cognitive functions. Results from the meta-analysis showed that sleep deprivation affects motor control with a very large effect size ($SMD = -0.87$), especially when deprivation occurs in the latter part of the night (PSDB), which contains the highest proportion of REM sleep ($SMD = -2.12$) (Yuxiang KONG and others, 2025, p 9). This large effect reflects the importance of REM sleep in motor memory consolidation and skill learning.

A study by (Ranel VENTER, 2014, pp 18–22) showed that sleep deprivation in tennis players led to a 25% decrease in serve accuracy and a 15% decrease in groundstroke accuracy. (Laura JULIFF and others, 2015, pp 680–684) also showed that 64% of athletes reported that their sleep was negatively affected before major competitions, with this effect associated with increased anxiety and decreased confidence in skill performance.

3.5. Impact of Sleep on Sports Injuries and Recovery

Sleep's importance extends beyond direct performance effects to its critical role in injury prevention and accelerating recovery processes. (Matthew MILEWSKI. and others, 2014, pp 129–133) showed that adolescent athletes who slept less than 8 hours per night were 1.7 times more likely to be injured compared to those who slept more than 8 hours, also showed that poor sleep quality is among the strongest predictors of sports injury risk in young athletes.

Regarding recovery, (Dale RAE, COETZEE, 2019) showed that sleep deprivation delays the process of restoring muscle glycogen stores after exercise and prolongs the period of elevated inflammatory markers, also showed that sleep extension in university athletes led to improved reaction time, increased shooting accuracy, and decreased perceived stress levels.

4. Risk Factors Specific to Athletes and Sleep Disorders

4.1. Unique Characteristics of Athletes and Sleep Disruption Factors

Athletes face a unique set of factors that negatively affect their sleep quality, differing from those affecting the general population. (Jessica GOODERICK and others, 2025, pp 245–258), in their narrative review, identified a set of athlete – specific factors contributing to poor sleep, most notably:

a. Training and Competition Pressure: Intensive training schedules and frequent competitions reduce the opportunity for adequate sleep, especially when training occurs in early morning or late evening hours. Studies have shown that early morning training reduces sleep duration the previous night by an average of 1–2 hours, while evening competitions delay sleep onset and increase wake time during the night (Charli SARGENT and others, 2014, p 23).

b. Competition – Related Anxiety: Studies have shown that 64% of athletes suffer from sleep disturbances before major competitions, especially on the night preceding competition. The study attributed the main reasons to competition – related thoughts (83.5%) and nervousness (43.8%) (Laura JULIFF and others, 2015, p 682). This anxiety leads to increased wake time during the night and decreased sleep efficiency.

c. Travel Across Time Zones: Traveling across multiple time zones leads to circadian rhythm disruption (jet lag), affecting sleep and wake timing, leading to decreased sleep quality and recovery, especially in the first days after travel (Charles SAMUELS, 2012, p 47).

d. Exercise – Related Pain: Muscle pain resulting from intense exercise increases wake time during the night and decreases sleep efficiency, especially

on nights following intense training (Christophe HAUSSWIRTH and others, 2014).

e. Exposure to Artificial Light and Screens: Exposure to blue light emitted from screens and electronic devices in the evening hours inhibits melatonin secretion and delays sleep onset, negatively affecting sleep quality among athletes who intensively use these devices (Melanie KNUFINKE and others, 2018, p 132).

4.2. Prevalence of Sleep Disorders Among Athletes

Studies indicate significantly higher rates of sleep disorders among athletes compared to the general population. In a systematic review covering 12 studies on Olympic athletes ($n = 596$), the average sleep duration was found to be only 6 hours and 10 minutes (Michele LASTELLA and others, 2015, pp 116–127).

A recent study on American university athletes (Division I) showed that the average sleep duration was 409.2 ± 36.3 minutes (approximately 6.8 hours), with a gap of up to 80 minutes between actual sleep duration and actual sleep need (Jason GOLDMAN and others, 2024, pp370–375). The study also showed that average sleep efficiency was only 61.6%, a rate much lower than the normal rate (>85%).

In a survey study covering 175 elite athletes, it was found that 97% of athletes do not get enough sleep to meet their subjective needs, with an average sleep deficit of approximately 60 minutes per night (Spencer ROBERTS and others, 2019, p 1382).

5. Strategies for Improving Sleep Quality to Enhance Sports Performance

5.1. Sleep Hygiene as a Preventive Approach

Sleep hygiene encompasses a set of behavioral and environmental practices aimed at enhancing an individual's ability to initiate and maintain sleep. Studies have shown that implementing sleep hygiene programs among athletes leads to notable improvements in sleep duration, efficiency, and quality (Shannon O'DONNELL, DRILLER, 2018, pp 1124–1129). (Jessica GOODERICK and others, 2025), in their narrative review, present a set of effective sleep hygiene components for athletes:

a- Regular Sleep and Wake Times: Maintain consistent sleep and wake times even on rest days to enhance circadian rhythm stability.

b- Appropriate Sleep Environment: The bedroom should be dark, quiet, and cool (18– 20°C), using light– blocking curtains.

c- Avoid Stimulants: Avoid caffeine, nicotine, and other stimulants in the afternoon and evening.

d- Regulate Light Exposure: Avoid blue light from screens 1– 2 hours before bedtime; promote natural light exposure in the morning.

e- Stress Management: Practice relaxation techniques, meditation, and deep breathing before bedtime.

f- Avoid Heavy Meals Before Bedtime: Have dinner 2– 3 hours before sleep; avoid sugary drinks and heavy meals.

5.2. Sleep Extension Strategies

Sleep extension strategies aim to increase athletes' actual sleep duration to approach optimal individual needs. Studies have shown that sleep extension leads to noticeable improvements in physical and skill - based performance and cognitive functions (Cheri MAH and others, 2011, p 947).

In a pioneering study, (Cheri MAH and others, 2011, pp 943–950) implemented a sleep extension intervention in university basketball players, extending sleep duration to 8.5 hours for 5 - 7 weeks. Results showed improvements in sprint time (by 4.8%), free throw accuracy (by 9.2%), and three - point shooting accuracy (by 13.7%), with decreased reaction time and improved overall mood. (Rebecca SWINBOURNE and others, 2016, pp 3370–3377) also showed that sleep extension in football players led to improved aerobic and anaerobic performance and decreased rate of perceived exertion.

Effective practices for sleep extension include:

- **Strategic Napping:** Short naps (20 - 30 minutes) to compensate for nocturnal sleep deficit (Michele LASTELLA and others, 2018, p 121).
- **Gradual Sleep Extension:** Increase sleep duration by 30 - 60 minutes per night while maintaining consistent wake - up times.
- **Weekend Catch - Up Sleep:** Compensate for part of the accumulated sleep deficit on rest days.

5.3. Additional Interventions to Improve Sleep

- **Mindfulness and Meditation:** Mindfulness programs lead to improved sleep quality and decreased anxiety (Jordan GROSS, VAN DER WATT, 2017, p 310).

- **Thermal Interventions:** Warm baths or saunas 1–2 hours before bedtime promote subsequent decline in core body temperature, stimulating sleep onset (Leon LACK and others, 2008, p 312).

- **Nutritional Supplements:** Melatonin (0.5–5 mg) may improve sleep onset and regulate circadian rhythm, especially during travel (Rebecca COSTELLO and others, 2014). Magnesium, glycine, and theanine may also contribute to improved sleep quality (Makoto BANNAI, KAWAI, 2012, p 146).

6. Recommendations

- **Integrate Sleep as a Strategic Priority:** Treat sleep as a fundamental component of the sports preparation program, allocating sufficient time in daily and weekly schedules.

- **Regular Sleep Assessment:** Use objective tools (actigraphy) or subjective tools (sleep diaries) to regularly assess sleep duration and quality (Jessica GOODERICK and others, 2025, p 29).

- **Tailor Sleep Hygiene Programs:** Design sleep hygiene programs to suit individual needs and sport-specific circumstances.

- **Consider Training and Competition Timing:** Avoid very early morning or late evening training when possible; allow sufficient sleep after evening competitions.

- **Manage Travel Across Time Zones:** Implement structured protocols for jet lag management, including gradual sleep adjustment, appropriate light exposure, and melatonin when necessary.

f. Continuous Education: Educate athletes and coaches about the importance of sleep and practical strategies to improve it.

Conclusion

This analytical study confirms the pivotal role of sleep quality in achieving sports excellence, as its impact extends beyond passive recovery to directly affect various components of physical, skill-based, and psychological performance. Accumulating scientific evidence has shown that sleep deprivation negatively affects aerobic and anaerobic endurance, muscular strength, speed, and motor control, with a notable increase in the rate of perceived exertion and elevated injury risks. The study also demonstrated that athletes face a unique set of factors affecting their sleep quality, including training and competition pressure, competition-related anxiety, and travel across time zones.

In light of these findings, the study confirms that improving sleep quality through sleep hygiene strategies, sleep extension, and supportive interventions constitutes an effective approach to enhancing sports performance and achieving excellence. Practitioners and coaches should integrate sleep as a strategic priority in sports preparation programs, with regular assessment of athletes' sleep and tailoring interventions according to their individual needs. Attention to sleep is not a luxury in the competitive sports world but a strategic investment in athlete health, performance, and ability to achieve accomplishments.

Sources and References

1. Bannai, M., & Kawai, N. (2012). New therapeutic strategy for amino acid medicine: Glycine improves the quality of sleep. *Journal of Pharmacological Sciences*, 118(2).
2. Borbély, A. A., Daan, S., Wirz-Justice, A., & Deboer, T. (2016). The two-process model of sleep regulation: A reappraisal. *Journal of Sleep Research*, 25(2).
3. Chennaoui, M., Arnal, P. J., Sauvet, F., & Léger, D. (2015). Sleep and exercise: A reciprocal issue? *Sleep Medicine Reviews*, 20.

4. Costello, R. B., Lentino, C. V., Boyd, C. C., O'Connell, M. L., Crawford, C. C., & Sprengel, M. L. (2014). The effectiveness of melatonin for promoting healthy sleep: A rapid evidence assessment of the literature. *Nutrition Journal*, 13(1), Article 106.
5. Craven, J., McCartney, D., & Desbrow, B. (2022). Effects of acute sleep loss on physical performance: A systematic and meta-analytical review. *Sports Medicine*, 52(11).
6. Goldman, J., Donohoe, B., Hatamiya, N., Boland, N. F., Vail, J., Holmes, K. E., Presby, D., Kim, J., & Duffaut, C. (2024). Baseline sleep characteristics in NCAA Division I collegiate athletes. *Clinical Journal of Sport Medicine*, 34(4).
7. Gong, B., Li, Y., & Zhang, Y. (2024). The effects of acute sleep deprivation on sports performance: A systematic review and meta-analysis. *Journal of Sports Sciences*, 42(3).
8. Gooderick, J., Wilson, S. M. B., & Searle, W. J. (2025). How to enhance sleep for athletes? A narrative review of sleep hygiene and sleep extension practices. *Current Sleep Medicine Reports*, 11, Article 28.
9. Grandner, M. A., & Athey, A. B. (Eds.). (2024). Sleep and sport: Physical performance, mental performance, injury prevention, and competitive advantage for athletes, coaches, and trainers. *Academic Press*.
10. Gross, J., & van der Watt, G. (2017). The effect of mindfulness-based interventions on sleep in athletes: A systematic review. *Journal of Clinical Sport Psychology*, 11(4).
11. Harrison, Y., & Horne, J. A. (2000). The impact of sleep deprivation on decision making: A review. *Journal of Experimental Psychology: Applied*, 6(3).
12. Hausswirth, C., Louis, J., Bieuzen, F., Pournot, H., & Brisswalter, J. (2014). Effects of whole-body cryotherapy vs. far-infrared vs. passive modalities on recovery from exercise-induced muscle damage in highly-trained runners. *PLoS ONE*, 9(12), Article e114554.
13. Irwin, M. R. (2015). Why sleep is important for health: A psychoneuroimmunology perspective. *Annual Review of Psychology*, 66.

14. Juliff, L. E., Halson, S. L., & Peiffer, J. J. (2015). Understanding sleep disturbance in athletes prior to important competitions. *Journal of Science and Medicine in Sport*, 18(6).
15. Knufinke, M., Nieuwenhuys, A., Geurts, S. A. E., Coenen, A. M. L., & Kompier, M. A. J. (2018). Sleep in elite athletes: A systematic review of the literature. *Sleep Medicine Reviews*, 42.
16. Kong, Y., Yu, B., Guan, G., Wang, Y., & He, H. (2025). Effects of sleep deprivation on sports performance and perceived exertion in athletes and non-athletes: A systematic review and meta-analysis. *Frontiers in Physiology*, 16, Article 1544286.
17. Lack, L. C., Gradisar, M., Van Someren, E. J. W., Wright, H. R., & Lushington, K. (2008). The relationship between insomnia and body temperatures. *Sleep Medicine Reviews*, 12(4).
18. Lastella, M., Halson, S. L., & Sargent, C. (2018). The role of napping in athletes: A systematic review. *Sleep Medicine Reviews*, 42.
19. Lastella, M., Roach, G. D., Halson, S. L., & Sargent, C. (2015). Sleep/wake behaviours of elite athletes from individual and team sports. *European Journal of Sport Science*, 15(2).
20. Leproult, R., Copinschi, G., Buxton, O., & Van Cauter, E. (1997). Sleep loss results in an elevation of cortisol levels the next evening. *Sleep*, 20(10).
21. Lopes, T., Oliveira, D. M., & Silva, B. M. (2023). The impact of sleep deprivation on endurance performance: A meta-analysis. *Journal of Sports Sciences*, 41(8).
22. Mah, C. D., Mah, K. E., Kezirian, E. J., & Dement, W. C. (2011). The effects of sleep extension on the sports performance of collegiate basketball players. *Sleep*, 34(7).
23. Milewski, M. D., Skaggs, D. L., Bishop, G. A., Pace, J. L., Ibrahim, D. A., Wren, T. A. L., & Barzdukas, A. (2014). Chronic lack of sleep is associated with increased sports injuries in adolescent athletes. *Journal of Pediatric Orthopaedics*, 34(2).
24. O'Donnell, S., & Driller, M. W. (2018). Sleep hygiene education in athletes: A systematic review. *Journal of Science and Medicine in Sport*, 21(11).

25. Porkka-Heiskanen, T., Kalinchuk, A. V., & Alanko, L. (2013). Adenosine, energy metabolism and sleep homeostasis. *Sleep Medicine Reviews, 17*(3).
26. Rae, D. E., & Coetzee, D. (2019). The impact of sleep extension on sports performance and recovery: A systematic review. *Sports Medicine, 49*(12).
27. Roberts, S. S. H., Teo, W.-P., & Warmington, S. A. (2019). Effects of sleep extension on sleep duration and performance in athletes: A systematic review. *Sports Medicine, 49*(9).
28. Rutkowska, M., Bieńko, M., Król, T., Toborek, M., Marchaj, M., Korta, K., Putra, A., Niedziela, N., Margas, M., & Bednarz, K. (2024). Sleep cycles and health: Role of sleep stages, circadian rhythms, and lifestyle factors on optimizing physical performance and mental well-being – A literature review. *Quality in Sport, 18*, Article 53398.
29. Samuels, C. H. (2008). Sleep, recovery, and performance: The new frontier in high-performance sportss. *Neurologic Clinics, 26*(1).
30. Samuels, C. H. (2012). Jet lag and travel fatigue: A comprehensive management plan for sport medicine physicians and high-performance support teams. *Clinical Journal of Sport Medicine, 22*(1).
31. Sargent, C., Halson, S., & Roach, G. D. (2014). Sleep and the athlete: A review of the literature. *Sleep and Biological Rhythms, 12*(Suppl. 1).
32. Simpson, N., & Dinges, D. F. (2007). Sleep and inflammation. *Nutrition Reviews, 65*(12 Pt. 2).
33. Skein, M., Duffield, R., Edge, J., & Short, M. J. (2011). Intermittent-sprint performance and muscle glycogen after 30 h of sleep deprivation. *Medicine & Science in Sports & Exercise, 43*(7).
34. Souissi, N., Chtourou, H., Aloui, A., Hammouda, O., Dogui, M., Chaouachi, A., & Chamari, K. (2013). Effects of time-of-day and partial sleep deprivation on short-term maximal performances of judo competitors. *Journal of Strength and Conditioning Research, 27*(9).

35. Spiegel, K., Tasali, E., Penev, P., & Van Cauter, E. (2004). Brief communication: Sleep curtailment in healthy young men is associated with decreased leptin levels, elevated ghrelin levels, and increased hunger and appetite. *Annals of Internal Medicine*, 141(11).
36. Swinbourne, R., Miller, J., & Smart, D. (2016). The effects of sleep extension on sleep, performance, and recovery in professional rugby league athletes. *Journal of Strength and Conditioning Research*, 30(12).
37. Van Cauter, E., Spiegel, K., Tasali, E., & Leproult, R. (2008). Metabolic consequences of sleep and sleep loss. *Sleep Medicine*, 9(Suppl. 1).
38. Venter, R. E. (2013). The role of sleep in the recovery of elite athletes. *South African Journal of Sports Medicine*, 26(1).
39. Vitale, J. A., & Weydahl, A. (2017). Chronotype, physical activity, and sport performance: A systematic review. *Sports Medicine*, 47(9).
40. Walker, M. P. (2009). The role of sleep in cognition and emotion. *Annals of the New York Academy of Sciences*, 1156.