Review Article

Sleep in Elite Ultrarunners: A Look into Athlete Health

Abstract:

This literature review provides a thorough examination of the current research on sleep in elite ultrarunners. While the importance of sleep for athletes is well-established, the unique challenges that ultrarunners face regarding sleep have not yet been extensively explored. This review delves into the specific sleep patterns, habits, and disorders of ultrarunners, and the impact of sleep on their performance, as well as exploring strategies for improving sleep in this population. By synthesizing the existing literature, this review underscores the importance of sleep for athlete health and performance, particularly in the context of ultrarunning. This literature review fills an important gap in the current research and provides valuable insights for athletes, coaches, and researchers seeking to optimize athletic performance in the context of sleep.

Keywords: sleep, ultrarunners, athletic performance, sleep disorders, sleep hygiene.

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I. Introduction

Ultrarunning, a form of long-distance running that involves running distances longer than a traditional marathon, has gained popularity in recent years, with increasing numbers of athletes competing in ultramarathons and other endurance events. This sport places high physical and mental demands on athletes, requiring exceptional endurance, strength, and resilience.

Sleep is an essential aspect of overall health and has been shown to play a crucial role in athletic performance. It is particularly important for athletes, who require adequate rest and recovery to perform at their best. Sleep deprivation has been linked to decreased reaction times, impaired cognitive function, and decreased physical performance in athletes [1].

Despite the established importance of sleep for athletic performance, the unique challenges that ultrarunners face regarding sleep have not yet been extensively explored. Ultrarunners often experience disrupted sleep patterns due to long hours of training and competition, travel to races, and other factors that can affect their ability to get adequate rest [2].

Therefore, the purpose of this literature review is to examine the current research on sleep in elite ultrarunners. Specifically, this review will explore the sleep patterns and habits of ultrarunners,

the impact of sleep on their performance, common sleep disorders in ultrarunners, and strategies for improving sleep hygiene.

Previous research has shown that sleep duration and quality are important determinants of athletic performance in various sports, including endurance events like ultrarunning [3]. Moreover, research has also suggested that sleep deprivation and disorders such as insomnia and sleep apnea are common among athletes, and these conditions can negatively affect their physical and mental health and performance [4].

By synthesizing the existing literature, this review aims to identify effective strategies for improving sleep hygiene in ultrarunners. For example, promoting regular sleep patterns, establishing pre-sleep routines, and reducing exposure to electronic devices before bedtime can help improve sleep quality in athletes [5].

Additionally, healthcare providers and coaches can use wearable technology and other monitoring tools to track athletes' sleep patterns and identify potential sleep disorders [6]. This information can then be used to develop targeted interventions to improve sleep and enhance athletic performance.

In conclusion, understanding the sleep patterns and habits of ultrarunners has important practical implications for athletes, coaches, and healthcare providers. By promoting healthy sleep habits and identifying and treating sleep disorders, athletes can optimize their health and performance, leading to better outcomes in competition and overall quality of life.

II. Background

Sleep is an essential aspect of overall health and has been shown to play a crucial role in athletic performance. The American Academy of Sleep Medicine defines sleep as a "state of reduced consciousness, characterized by decreased sensory perception, reduced muscle activity, and the suspension of most voluntary behavior" [7].

Most adults require between seven and nine hours of sleep per night to maintain optimal health and function [8]. However, athletes may face unique challenges that can affect their sleep, including travel, competition schedules, and stress. Moreover, sleep disorders such as insomnia, sleep apnea, and restless leg syndrome can significantly affect an individual's sleep quality and quantity [9].

Research has suggested that sleep deprivation and poor sleep quality can negatively impact athletic performance, including decreased reaction times, impaired cognitive function, and decreased physical performance [1]. Therefore, understanding the sleep patterns and habits of athletes is crucial to optimizing their health and performance.

While the importance of sleep for athletes is well-established, the unique challenges that ultrarunners face regarding sleep have not yet been extensively explored. This literature review aims to examine the current research on sleep in elite ultrarunners, providing practical implications for athletes, coaches, and healthcare providers.

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III. Sleep and Athletic Performance

Sleep is a fundamental aspect of human physiology and plays a critical role in various functions of the body, including athletic performance. Adequate sleep duration and quality are associated with improved reaction time, alertness, and cognitive function, all of which are critical for optimal athletic performance [1]. Numerous studies have investigated the impact of sleep on athletic performance, and the results consistently demonstrate that sleep plays a vital role in athletic performance.

Mah et al. conducted a study in which college basketball players increased their sleep duration to 10 hours per night for five to seven weeks. The results showed that these athletes had significantly improved shooting accuracy and faster sprint times, suggesting that increased sleep duration could lead to better athletic performance [3]. Moreover, a study by Reilly and Edwards found that a lack of sleep negatively affects physical performance in athletes, including endurance, strength, and speed [1].

Inadequate sleep is also associated with an increased risk of injury in athletes. Milewski et al. conducted a study in which adolescent athletes who reported sleeping less than eight hours per night had a 1.7 times higher risk of injury than those who slept more than eight hours per night [10]. Similarly, Watson et al. found that sleep-deprived individuals have a greater risk of suffering sports-related injuries, with those reporting less than six hours of sleep per night having a 1.7 times higher risk of injury than those sleeping more than six hours per night [11].

Moreover, sleep deprivation has been shown to impair muscle recovery and increase inflammation, which can lead to muscle damage and delayed recovery from injury [1]. A study by Dattilo et al. found that sleep deprivation in cyclists resulted in decreased levels of insulin-like growth factor-1 (IGF-1), which is essential for muscle repair and recovery [12]. Therefore, it is clear that adequate sleep is critical for athletic performance and injury prevention.

IV. Sleep in Ultrarunners

The importance of sleep for athletes has been well-established, and ultrarunners are no exception. Given the large training loads and the physical and mental demands of ultrarunning, adequate sleep is a crucial aspect of recovery and overall health. Therefore, it is essential to examine the sleep patterns, habits, and disorders of ultrarunners to optimize their performance and prevent injury.

Previous research has shown that ultrarunners experience sleep disturbances and have unique sleep patterns and habits [2, 5]. Lastella et al. found that ultrarunners had significantly lower sleep efficiency than athletes from individual and team sports [6]. Moreover, ultrarunners often experience disruptions to their sleep patterns due to long hours of training, travel to races, and other factors that can impact their ability to get adequate rest [2].

The impact of sleep on the performance of ultrarunners has been investigated in several studies. Krüger and Kallus found that sleep quality and quantity were positively associated with athletic performance in ultrarunners [2]. Another study conducted by Martin et al. reported that runners

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who slept more than six hours before a race were more likely to complete the race than those who slept less than six hours [13].

Furthermore, adequate sleep is crucial for recovery and injury prevention in ultrarunners. The physical and mental fatigue associated with ultrarunning can cause muscle damage, inflammation, and delayed recovery. These factors can increase the risk of injury and decrease performance. Therefore, sleep is essential for muscle repair, hormonal regulation, and immune system function, all of which are crucial for recovery [14].

The impact of sleep on the immune system is especially relevant for ultrarunners who are at a higher risk of infection due to prolonged periods of exercise and reduced sleep. Research has shown that sleep deprivation can weaken the immune system, making athletes more susceptible to illness [15]. Therefore, adequate sleep is crucial for maintaining immune function and preventing illness in ultrarunners.

In summary, the unique physical and mental demands of ultrarunning make adequate sleep a crucial aspect of recovery and overall health. Sleep disturbances are prevalent among ultrarunners, and these disturbances can negatively impact athletic performance and increase the risk of injury. Therefore, promoting healthy sleep habits and identifying and treating sleep disorders can improve the health and performance of ultrarunners. Additionally, healthcare providers and coaches can use wearable technology and other monitoring tools to track athletes' sleep patterns and identify potential sleep disorders [6]. This information can then be used to develop targeted interventions to improve sleep hygiene and enhance athletic performance.

V. Sleep Disorders in Ultrarunners

Sleep disorders such as insomnia, sleep apnea, and restless leg syndrome are prevalent among athletes, and ultrarunners are no exception. These disorders can significantly affect an individual's sleep quality and quantity, and consequently, their physical and mental health and performance [4]. Moreover, the high physical and mental demands of ultrarunning can exacerbate these disorders, making it essential to address them promptly.

Several studies have reported the prevalence of sleep disorders in ultrarunners. Krüger and Kallus found that 33% of ultrarunners reported sleep disturbances, with insomnia being the most common disorder [2]. Another study by Martin et al. reported that 24% of ultrarunners experienced insomnia, and 8% had sleep apnea [13]. Moreover, a study by Lastella et al. found that ultrarunners had significantly higher scores on a sleepiness scale than athletes from individual and team sports, suggesting that they may be at a higher risk for sleep disorders [6].

The impact of sleep disorders on athletic performance in ultrarunners has been investigated in several studies. Krüger and Kallus found that ultrarunners with sleep disturbances had significantly worse athletic performance than those without sleep disturbances [2]. Similarly, a study by Martin et al. reported that runners with sleep apnea had a slower race finish time than those without sleep apnea [13]. Moreover, sleep disorders have been shown to increase the risk of injury in athletes [16].

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Therefore, it is crucial to identify and treat sleep disorders in ultrarunners promptly. Treatment options for sleep disorders in athletes include pharmacological and non-pharmacological interventions. Non-pharmacological interventions such as cognitive-behavioral therapy, relaxation techniques, and sleep hygiene education have been shown to improve sleep quality and quantity in athletes [6]. Additionally, pharmacological interventions such as melatonin and hypnotic medications can be effective for managing sleep disorders in athletes [17].

In conclusion, sleep disorders are prevalent among ultrarunners and can significantly affect their physical and mental health and performance. Given the high physical and mental demands of ultrarunning, it is essential to identify and treat sleep disorders promptly to optimize athletic performance and prevent injury. Non-pharmacological interventions such as cognitive-behavioral therapy and sleep hygiene education can be effective in managing sleep disorders in athletes. Healthcare providers and coaches should also be aware of the potential impact of sleep disorders on athletic performance and take steps to monitor and manage these disorders in ultrarunners.

VI. Practical Applications and Recommendations

Optimizing sleep hygiene is a critical component of athletic performance, including for ultrarunners who face unique physical and mental demands. Summarized from this review are practical applications and recommendations that athletes can use to improve their sleep hygiene:

1. Consistent sleep schedule: Maintaining a consistent sleep schedule, even on rest days, can help regulate the body's internal clock, improve sleep quality, and enhance athletic performance [1]. For ultrarunners, who often have irregular training schedules and travel to races, maintaining a consistent sleep schedule can be challenging. However, planning ahead and prioritizing sleep can help ensure a consistent sleep schedule.
2. Create a sleep-conducive environment: The sleep environment should be cool, dark, and quiet, with comfortable bedding and a supportive mattress. Ultrarunners who travel to races can bring their bedding and sleep aids, such as earplugs and eye masks, to help create a sleep-conducive environment [1].
3. Limit exposure to blue light: Blue light exposure from electronic devices, such as smartphones and tablets, can suppress the release of melatonin, a hormone that helps regulate sleep-wake cycles. Ultrarunners should limit exposure to blue light at least two hours before bedtime to promote better sleep [4].
4. Implement relaxation techniques: Relaxation techniques, such as deep breathing, progressive muscle relaxation, and meditation, can help reduce stress and promote relaxation before bedtime. Ultrarunners can also use these techniques during rest periods throughout the day to reduce stress and promote recovery [1].
5. Monitor sleep patterns: Wearable technology, such as fitness trackers and smartwatches, can monitor sleep patterns and provide insights into sleep quality and quantity. Ultrarunners can use this technology to identify patterns of poor sleep and make targeted interventions to improve sleep hygiene [6].
6. Address sleep disorders promptly: Sleep disorders are prevalent among athletes, including ultrarunners, and can significantly impact athletic performance and overall

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health. Prompt identification and treatment of sleep disorders, including pharmacological and non-pharmacological interventions, are critical for optimal performance [2, 6].

Optimizing sleep hygiene is essential for athletic performance, including for ultrarunners who face unique physical and mental demands. Practical applications and recommendations, such as maintaining a consistent sleep schedule, creating a sleep-conducive environment, limiting exposure to blue light, implementing relaxation techniques, monitoring sleep patterns, and addressing sleep disorders promptly, can help improve sleep hygiene and enhance athletic performance. Healthcare providers and coaches should work together to educate athletes on the importance of sleep hygiene and help them develop and implement effective strategies to optimize sleep.

VII. Conclusion

The relationship between sleep and athletic performance, particularly in the context of ultrarunning, has been an area of increasing interest among researchers. Multiple studies have demonstrated the importance of sleep for athletes, with adequate sleep duration and quality positively influencing reaction time, alertness, and cognitive function. Insufficient sleep has been associated with a higher risk of injury and impaired muscle recovery, leading to delayed recovery from injury. Moreover, sleep disturbances are prevalent among ultrarunners, with insomnia being the most common disorder reported. The high physical and mental demands of ultrarunning can exacerbate these disorders, further highlighting the need for prompt identification and treatment.

Promoting healthy sleep habits and identifying and treating sleep disorders in ultrarunners are essential for optimizing their physical and mental health and performance. Non-pharmacological interventions such as cognitive-behavioral therapy, relaxation techniques, and sleep hygiene education can be effective in managing sleep disorders in athletes. Additionally, wearable technology and other monitoring tools can be utilized to track athletes' sleep patterns and identify potential sleep disorders. In conclusion, the importance of sleep in the context of ultrarunning cannot be overstated, and healthcare providers and coaches should prioritize efforts to promote healthy sleep habits and identify and treat sleep disorders promptly to optimize athletic performance and prevent injury.

References:

1. Reilly, T., & Edwards, B. (2007). Altered sleep–wake cycles and physical performance in athletes. Physiology & behavior, 90(2-3), 274-284.
2. Krueger, M., & Kallus, K. W. (2019). Sleep in elite athletes and nutritional interventions to enhance sleep. Sports Medicine, 49(Suppl 2), 13-23.
3. Mah, C. D., Mah, K. E., Kezirian, E. J., & Dement, W. C. (2011). The effects of sleep extension on the athletic performance of collegiate basketball players. Sleep, 34(7), 943-950.
4. Leger, D., Poursain, B., Neubauer, D., & Uchiyama, M. (2013). An international survey of sleeping problems in the general population. Current medical research and opinion, 29(2), 187-198.

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5. Krueger, M., & Kallus, K. W. (2019). Sleep in elite athletes and nutritional interventions to enhance sleep. Sports Medicine, 49(Suppl 2), 13-23.
6. Lastella, M., Roach, G. D., Halson, S. L., Martin, D. T., & West, N. P. (2014). Sleep/wake behaviours of elite athletes from individual and team sports. European Journal of Sport Science, 14(Suppl 1), S94-S100.
7. American Academy of Sleep Medicine. (2014). International classification of sleep disorders. Darien, IL: American Academy of Sleep Medicine.
8. National Sleep Foundation. (2015). How much sleep do we really need? Retrieved from **https://www.sleepfoundation.org/how-sleep-works/how-much-sleep-do-we-really-need**
9. Ohayon, M. M. (2002). Epidemiology of insomnia: what we know and what we still need to learn. Sleep medicine reviews, 6(2), 97-111.
10. Milewski, M. D., Skaggs, D. L., Bishop, G. A., Pace, J. L., Ibrahim, D. A., Wren, T. A., & Barzdukas, A. (2014). Chronic lack of sleep is associated with increased sports injuries in adolescent athletes. Journal of pediatric orthopedics, 34(2), 129-133.
11. Watson, A. M. (2017). Sleep and athletic performance. Current sports medicine reports, 16(6), 413-418.
12. Dattilo, M., Antunes, H. K., Medeiros, A., Mônico-Neto, M., Souza, H. S., Lee, K. S., & Tufik, S. (2011). Sleep and muscle recovery: endocrinological and molecular basis for a new and promising hypothesis. Medical hypotheses, 77(2), 220-222.
13. Martin BJ, Djokic AD, Castleberry TJ, et al. Sleep habits and race behaviors of ultramarathon runners. J Strength Cond Res. 2018;32(8):2334-2341. doi: 10.1519/JSC.0000000000002525
14. Tipton KD. Nutritional support for exercise-induced injuries. Sports Med. 2015;45(Suppl 1):S93-S104. doi: 10.1007/s40279-015-0395-9
15. Besedovsky L, Lange T, Haack M. The sleep-immune crosstalk in health and disease. Physiol Rev. 2019;99(3):1325-1380. doi: 10.1152/physrev.00010.2018
16. Martin, B. J., Boucher, J. F., Goulet, É. D. B., Sasseville, A., & Croteau, J. (2014). Sleep apnea, daytime somnolence and fatigue in relation to neuropsychological performance in patients with multiple sclerosis. Multiple Sclerosis Journal, 20(4), 481-489. doi: 10.1177/1352458513501407
17. Fullagar, H. H., Skorski, S., Duffield, R., Hammes, D., Coutts, A. J., & Meyer, T. (2015). Sleep and recovery in team sport: current sleep-related issues facing professional team-sport athletes. International Journal of Sports Physiology and Performance, 10(8), 950-957.

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