REST AND RECOVERY

How sleep plays a critical role in athletic performance

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Those in sports often have to consider the time they spend practicing while balancing all the other aspects of their lives. Oftentimes, sleep goes by the wayside.

Competitive results and athletic performance are highly reliant on sleep. Sleep is just as important as a correct diet and physical conditioning, and winning may be directly related to rest and sleep in between practice and contests.

Usain Bolt, the fastest man in the world, credits sleep as the most important part of his exercise and training regimen. "Sleep is extremely important to me," he has said. "I need to rest and recover in order for the training I do to be absorbed by my body." LeBron James said he sleeps around 12 hours a night, while Roger Federer tries to sleep 11 to 12 hours a night.

Preparing the body to function properly is the main purpose of sleep. Within this function is the supposition that the body uses sleep to recover from the stresses received during the previous waking period. These are the theoretical reasons why living creatures sleep, but these reasons are not fully understood.

Daytime functioning is markedly affected by an individual's sleep history. Mood and performance suffer when a person's sleep is restricted to less than six hours per night for four or more consecutive nights. Immune function, appetite regulation and glucose metabolism all suffer with such sleep restriction.

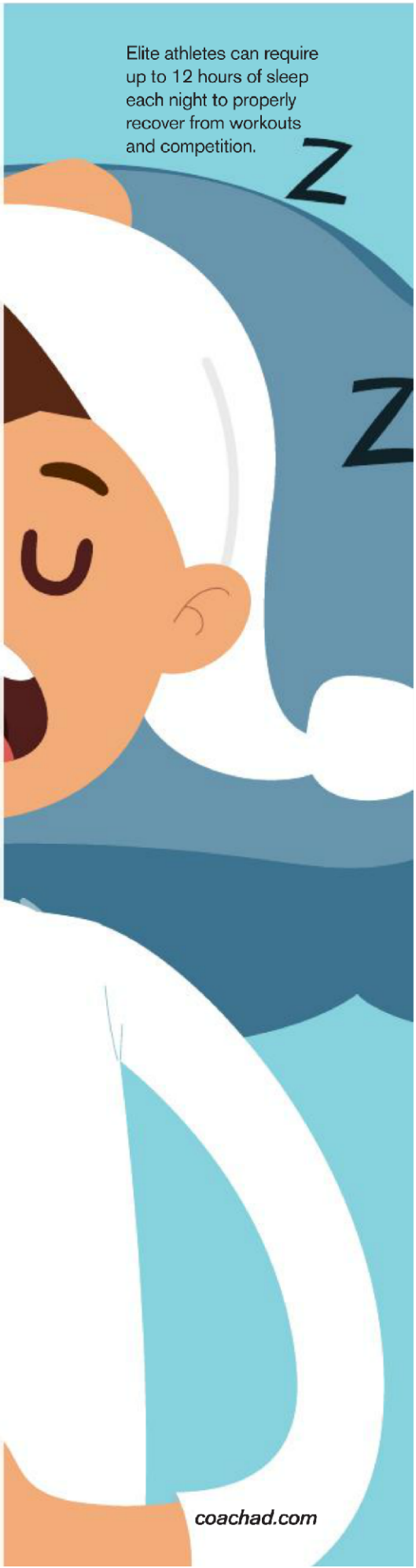
Eight hours of sleep per night has been touted as the quantity necessary for individuals to avoid the occurrence of neurobehavioral deficits. Elite athletes need to be studied further with regards to their sleep habits. No other population is subjected to such high-intensity training that requires such crucial recovery, yet makes the correct quantity and quality sleep less likely to occur.

Unresponsiveness to and disengagement from the environment are the two characteristics that define the sleep state. However, there are complex physiological processes that occur in sleep as well.

There are non-rapid eye movement (NREM) and rapid eye movement (REM) stages that divide sleep. These two stages can be differentiated with the use of electroencephalography (EEG) since brain activity is so decidedly different between the two.

A progressive depth of sleep is noted in NREM sleep. On the other hand, REM sleep is characterized by decreased muscle tension, or atonia. Most notable during this stage is that dreaming occurs, accompanied by darting eye movements. As the brain becomes active during REM sleep, the body is essentially paralyzed by the decreased muscle tension.

Recovery in athletes appears to correlate with the amount of short-wave sleep (SWS) they get. Growth hormone release is synchronized with SWS, implying that it is during this phase of sleep that the ability of the body to repair itself is highest.



Elite athletes can require up to 12 hours of sleep each night to properly recover from workouts and competition.

Wakefulness following sleep also increases with the amount of SWS that athletes are able to get.

As exertion increases, the need for sleep post-exertion increases; yet, wakefulness also increases after exertion, most commonly due to muscle pain, among other factors. This phenomenon makes sleep harder to get for those athletes who need it.

After exertion, SWS increases in athletes' sleep. This shift toward SWS post exertion implies that the body knows that this is the kind of sleep it needs to better repair itself.

Quantity and quality of sleep is important for athletes. There are physical and mental benefits to getting a good amount of REM sleep. The proper release of hormones in the body, the brain's ability to consolidate memory, and the body's ability to repair itself suffer when there is a lack of sleep or disordered sleep.

More studies need to be done to correlate various aspects of athletic performance with sleep quantity and quality. Nonetheless, several phenomena have been observed. Anaerobic performance only suffers significantly if sleep deprivation has reached a total of 30 hours, while aerobic performance already suffers with just 24 hours of sleep deprivation. One-off maximal efforts do not affect sleep as much as repeated or sustained bouts of exercise. Sleep deprivation of 36 hours decreases peak power, whereas 24 hours of sleep deprivation does not. Thirty hours of sleep deprivation decreases isokinetic performance and leads to worsened total sprint times. Weightlifters' total volume load, training intensity, and performance tasks are not affected by 24 hours of sleep deprivation, but mood states are significantly altered, resulting in greater fatigue, less vigor and more confusion.

Hitting accuracy in tennis players go up by about 40 percent when they get adequate sleep, and the split-decision-making ability goes up by about 4 percent when athletes are allowed to sleep to their satisfaction. Not allowing weightlifters to sleep adequately lowers the amount they can maximally bench press by 20 pounds.

Some of the greatest sports figures have spoken about the importance of sleep. Concentration, performance and mood are said to improve with adequate sleep, while poor sleep leads to diminished ability to make split-second decisions and decreased performance. Conversely, enough rest appears to increase accuracy in sports performance.

Muscle breakdown and fluid depletion occurs with exercise; recovery is therefore important after exercise to rebuild muscle and bring up fluid stores. There is also an improved ability to absorb and use nutrients with adequate sleep, something that athletes need to ensure is happening after exertion.

Cortisol, a stress hormone produced by the body, increases with sleep deprivation. The amount of carbohydrates stored for energy during physical activity decreases in sleep-deprived athletes, and the quantity of glycogen produced during exertion also decreases. Additionally, postgame recovery is slower in sleep-deprived athletes, causing them to be more fatigued overall. Game focus and energy level suffers as well with sleep deprivation.

With training and competition, sleep should be considered an essential component. Unfortunately, it's precisely this intense training and competition that make it difficult for athletes to sleep properly. Short, maximal efforts appear to disturb sleep less than prolonged, submaximal exertion. Performance can be enhanced even by napping and sleep extension. Not surprisingly, athletic performance improves with the practice of good sleep hygiene.

The proper amount of sleep is necessary for both those wishing to perform at an elite level and even those who just exercise for fun. Combined with a proper diet, correct sleep patterns maximize the effects of good exercise. Recovery time, reaction time and athletic performance all improve with proper sleep. Athletic training regimens should have sleep factored in, and this is fortunately starting to become a practice in most sports. CAD

References

Davenne, D. (2009). 'Sleep of athletes–problems and possible solutions', Biological Rhythm Research, 40(1), pp.45-52.

Fullagar, H.H., Skorski, S., Duffield, R., Hammes, D., Coutts, A.J. and Meyer, T. (2015). 'Sleep and athletic performance: the effects of sleep loss on exercise performance, and physiological and cognitive responses to exercise', Sports Medicine, 45(2), pp.161-186.

Halson, S.L. (2008). 'Nutrition, sleep and recovery', European Journal of Sport Science, 8(2), pp.119-126.

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