

Early Morning Training and Sleep Deprivation: Facts and Solutions

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“Sleep is a weapon!”
(Robert Ludlum, *The Bourne Identity*, 1980)

The coronavirus pandemic has brought significant change to the swimming community. During the isolation period, we've been forced to reflect on our lifestyles. Many swimmers have jumped at the chance to catch up on sleep during the pandemic.

Sleep is one of the body's most important biological functions and contributes to physical and intellectual performance, cognition, learning, physiological development, and mental and physical health. For decades, early morning training has been the greatest pride of swimmers. However, sleep deprivation has been linked to poor recovery, injury, illness, and long-term health problems.

Problem, Facts, Scientific Data, Implications

Sleep deprivation has been the subject of many studies and blogposts. The Australian Department of Health recommends¹ 9-11 hours of uninterrupted sleep per night for 5-13 year-olds, 8-10 hours for those aged 14-17, and 7-9 hours for those aged 18-64, as well as consistent bed and wake-up times.

Almost every weekday swimmers arrive home at 7PM at the earliest, and that is before showering, eating, and downtime. Those who are students also need to do homework. Their bed time could average at 11PM or so. For most, training starts at 5:30AM, so they are getting up between 4:00 and 5:00AM. It's almost impossible for adolescents to get the minimum recommended amount of sleep. When this schedule takes up 46-48 weeks of the year, it leads to chronic sleep deprivation, which impacts swimmers' academic performance and general health.

A study² conducted in Australia from 2008-2012 revealed the following:

1. “Athletes self-reported poorer mood, and higher exertion ... effects on perceived mood and exertion could impair an athlete's motivation, and thus their ability to train effectively;
2. “... impaired immune function ... places [athletes] at greater risk of developing upper respiratory tract infections and other health problems.
3. “... impaired cognitive capacity, glucose metabolism and appetite regulation ... could impair the training performance of elite athletes.”

The results of this study also indicate that training schedules requiring early morning starts reduce sleep to a level below the recommended target for healthy adults. While an obvious strategy to compensate for early morning starts is an earlier bedtime, the presence of a physiologically 'forbidden zone' for sleep may discourage individuals from going to bed earlier than usual. In the case of swimmers, delaying morning training by 2 or 3 hours would enable them to obtain more sleep than they currently do.

In 2019, the British Medicine Journal published a study³ on sleep in elite swimmers. The researchers found that variations in sleep time are related to early morning (in this study, 6:30AM) training, which can leave an athlete in a perpetual state of exhaustion and prolong the recovery process. It might be reasonable to suggest that people who get up early should also go to bed earlier. However, participants in this study (as with the majority of elite swimmers around the world) were not able to achieve that. The most common reasons were social, school or family commitments. The study recommended delaying early morning sessions by 2 hours to allow athletes enough sleep each night.

A number of research studies revealed the following negative effects of prolonged sleep deprivation:

- significant loss of brain cells required for alertness (Journal of Neuroscience; Forbes Magazine⁴, 2014);
- impaired immune system (University of Helsinki⁵, 2013);
- reduced lifespan (University of Warwick, University of Naples⁶, 2012);
- premature ageing and age-related diseases (State University of São Paulo⁷, 2014);
- higher risk of developing cancers, increased skin damage, difficulty learning new information, and more (Business Insider Australia⁸, 2019);
- foggy thoughts, daytime drowsiness, limited attention span, increased cortisol levels, weakened immune system, unstable mood, impaired memory and decision-making; long-term effects include obesity, diabetes, and heart disease (Seventh Generation⁹, 2015).

The National Sleep Foundation (USA) reports¹⁰ that adolescent sleep patterns are naturally delayed. Mature adolescents have later circadian rhythm timing, making it physiologically difficult for them to sleep earlier at night and wake up earlier in the mornings. Sufficient sleep would result in improved athletic performances in training and competition¹¹.

A 2008 study¹² involving students on the Stanford University men's and women's swimming teams showed that when athletes extended sleep to 10 hours per night for 6-7 weeks, they swam a 15-meter sprint 0.51 seconds faster, reacted 0.15 seconds quicker off the blocks, improved turn time by 0.10 seconds, and increased kick strokes by 5 kicks.

All of this scientific evidence suggests that for many (but not all) athletes in serious training programs, excessive early morning training can lead to sleep deprivation, lower academic performance, and overtraining. This would also suggest that a number of potentially world-class swimmers retire from sport prematurely after struggling to handle stress caused by sleep debt. Those who remain in their sport may be subject to negative health effects of years of accumulated sleep deprivation later in life, after finishing their sporting careers.

Although early morning starts are common in our sport, no scientific data has been published to indicate a sound physiological rationale to train early in the mornings. Rather, it is likely that early morning starts are a legacy from a time when non-professional athletes had to train before work or school. Even now, school-aged swimmers can still receive adequate sleep and make it to school on time while training to the capacity suitable for them.

Possible Solutions

Now that we have identified problems stemming from sleep deprivation, here are some solutions to maximize sleep time and improve athlete performance.

1. SLEEP HYGIENE

The National Sleep Foundation recommends:

- **Limiting daytime naps to 30 minutes.** Napping does not make up for inadequate nighttime sleep, but a short nap of 20-30 minutes can help to improve mood, alertness and performance.
- **Avoiding stimulants such as caffeine and alcohol close to bedtime.** While alcohol is known to help you fall asleep faster, too much close to bedtime can disrupt sleep in the second half of the night as the body begins to process the alcohol.
- **Steering clear of food that can be disruptive right before sleep.** Heavy or rich foods, fatty or fried meals, spicy dishes, citrus fruits, and carbonated drinks can trigger indigestion for some people. Eat carbohydrates such as bread, milk, cheese, and potato. These take longer to break down and provide "slow-release" energy the next day. If eating close to sleep time, food should be snack-sized. Upon waking, eat protein such as eggs. Proteins are digested best in the mornings and promote tissue growth and regeneration.

- **Ensuring adequate exposure to natural light.** Exposure to sunlight during the day, as well as darkness at night, helps to maintain a healthy sleep-wake cycle.
- **Establishing a regular relaxing bedtime routine.** A regular nightly routine helps the body recognize bedtime. For example, a warm shower or bath, reading a book, or light stretches. Try to avoid emotionally upsetting conversations and activities before attempting to sleep.
- **Making sure that the sleep environment is pleasant.** Mattress and pillows should be comfortable. The bedroom should be cool (~20°). Bright light from lamps, mobile phone and TV screens can make it difficult to fall asleep. Consider blackout curtains, eye shades, ear plugs, “white noise” machines, humidifiers, fans and other devices that can make the bedroom more relaxing.

2. IMPROVING WAKEFULNESS AND SLEEP LOSS FATIGUE MANAGEMENT

Modified military¹³ and aviation industry¹⁴ strategies relevant to sports training:

Improving Wakefulness:

- Frequent breaks during training to alleviate strain and boredom (give short motivational talks);
- Increase social support: pair athletes to promote companionship, support and check in with one another. Arrange small teams rather than individuals to perform tasks where possible.
- When fatigue is due to sleep loss (rather than physical effort), include periods of mild effort or short bursts of strenuous activity;
- Plan to change routines and rotate training tasks. Cross-training athletes in a variety of skills is one option.

Sleep Deprivation Fatigue Management - measures coaches can implement:

- Include sleep requirements in seasonal planning. Prepare different sleep plans for each potential training/competition scenario;
- Allow adequate sleep before competitions. Avoid sleep debt (that is, the amount of sleep required to restore normal performance levels) both in yourself and your athletes;
- Reassure rather than pressure. Be sensitive to mood changes in your athletes (especially in teenagers). Don't overreact to uncharacteristic outbursts that are a likely reaction to stress and fatigue;
- As fatigue increases, coaches may need to modify their leadership behaviours by giving simple instructions slowly and clearly and being tolerant of errors;
- Allow sleep-deprived athletes to complete self-paced training tasks. Sleep loss has less impact on these types of tasks as opposed to tasks that are work-paced. **For example**, implement **rest intervals** instead of repeats within a given time cycle.

Another example is the “**Last In, First Out**” set: athletes perform a training set in a small group starting off 5 or 10 seconds apart; upon finishing each repeat, the leader waits for the last athlete to finish; as soon as the last athlete finishes, the leader starts off followed by the rest of the group.

The “Plus 7” Test: This simple test is used to assess short-term memory (particularly affected by sleep loss) and reliably detect mental lapses. The “Plus 7” task is a continuous addition exercise. Begin by choosing a random number between 5 and 9. Add 7 to get the sum. These additions are to be done in one's head, remembering the sum, and calculating the new sum. If athletes can continue this task for at least one minute, without long pauses or mistakes, they are probably not experiencing severe sleep loss effects.

3. EFFECTIVE PLANNING OF TRAINING SCHEDULE

The coach should carefully plan training programs (day, microcycle, mesocycle) to avoid negative impacts on sleep time, both in the morning and evening.

SCIENCE BASED VS TRADITION BASED TRAINING SESSION DESIGN

Traditional swimming training advocates high volume completed at relatively slow speed. However no scientific evidence proves a direct relation between training volume and performance.

World famous exercise physiologist David Costill determined^{16,17} that competitive swimmers on lower training loads do not lose fitness; in fact, they often *improve* their performances. Scientific data¹⁸ support more significant performance gains through a program based on high intensity and low volume. The implication of this research is that coaches may consider designing lower volume morning training sessions. This would allow later morning starts and an accumulation of sleep time to assist swimmers' recovery.

CONCLUSION

Sleep has been described as the cheapest, most effective recovery tool available; while many athletes spend a significant amount of money on supplements, recovery practices (massage, nutritionist & physiotherapist consultations) and medicine, sleep is ingrained into our behaviour from birth. Even though the importance of sleep is scientifically proven, changing the culture of our sport will be a long and challenging process. The key is to educate coaches, swimmers, and parents on science-based decision making. It is also important to note that coaches have an ethical and working obligation of self-care and should practice the measures outlined in this report just as much as swimmers to remain effective.

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Further reading:

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