# Capitol Sleep Medicine Newsletter

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# Sleep and Exercise

We all know that exercise does a body good but what is exactly is the effect of exercise on sleep?

The expectation that exercise will benefit sleep can partly be attributed to traditional hypotheses that sleep serves energy conservation, body restoration or thermoregulatory functions, all of which have guided much of the research in this field.[1] Electroencephalographic changes during sleep on the night following exercise may include an increase in slow wave sleep (SWS), primarily with subjects who are physically fit. At least one function of SWS is that it may provide restoration of the body. This idea is based on the fact that serum growth hormone has a circadian rhythmicity with a maximum serum concentration in the first third of the night when SWS is also most prominent.[2] Between-study comparisons indicate that trained subjects may have higher baseline SWS values than have untrained subjects. Following acutely increased exercise (usually only one day), untrained subjects may show transient SWS elevations limited to the first part of sleep, and trained subjects may show increases of SWS throughout the night.[3]

Moderate amounts of exercise may be beneficial to sleep but what about more extreme levels of exercise? An interesting study of eight fit male endurance athletes, ages 23-42 yr, had their sleep studied on four separate occasions: after a day on which no specific exercise was performed; after a day of a 15-km run; after a 42.2-km run day; after a day in which the athletes participated in a strenuous ultra-triathlon. Sleep patterns following the first three situations were similar. The sleep pattern of the ultra-triathlon day when compared with the other three days showed significantly increased wakefulness and delayed and decreased rapid eye movement (REM) sleep. The duration of SWS in the first 6 h after lights out, however, was no different. The authors concluded that increased wakefulness and decreased REM clearly indicate increased stress after the ultra-triathlon, and that REM sleep appears to be a more sensitive index of exercise induced stress than SWS.[4]

A study of thirteen well-trained male street cyclist members of the German national amateur team also looked at the effects of more strenuous levels of exercise. Subjects had a mean age of 23.9 years, with a mean body mass index 21.9 kg/m2. Each subject was studied on the night following a race competition and several weeks later following a recovery period with no strenuous training between the two studies. Compared with the recovery night of testing, the competition day revealed increased urinary excretion of epinephrine and norepinephrine. The REM onset latency was significantly prolonged and REM percent of total sleep was significantly decreased in the first half of the night in the training compared to the resting condition. The authors concluded that the prolonged REM latency was correlated with increased epinephrine excretion on the day of exercise.[5] This stands to reason as the noradrenergic locus coeruleus has minimal function during REM sleep, and that its activity must decrease to minimal levels before REM sleep can occur.[6]

An interesting study of this subject took a different methodological approach by decreasing the degree of activity in highly active people. Fifteen trained athletes who exercised daily at a moderate to high intensity were asked to remain sedentary in the laboratory for an entire day prior to their polysomnogram. They were also studied after a normal day of moderate to high activity in a counterbalanced design. In the sedentary condition, SWS decreased by a mean of 15.5+/-7.0 min and REM sleep increased by a mean of 17.9+/-5.7 min, while REM sleep latency decreased by 24.0+/-6.8 min. With reduced exercise load, SWS pressure may have been reduced, resulting in lower levels of SWS and increased REM sleep in a compensatory fashion. Thus, the data indicate that reducing exercise has significant effects on sleep that may have implications for athletes tapering for competition.[7]

What about swimming? A study was performed in female swimmers across a competitive swimming season, that is, at the start of the season, during peak training period, and after a precompetition reduction in training. REM sleep times were similar at all three training levels. SWS formed a very high percentage of total sleep in the onset (26%) and peak (31%) training periods, but was significantly reduced following precompetition taper (16%), supporting the theory that the need for restorative SWS is reduced with reduced physical demand.[8] Let's all get out there and get some exercise!

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